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EFFECTS OF POLLUTION ON WATER QUALITY PERDIDO RIVER AND BAY, ALABAMA AND FLORIDA

FEDERAL WATER POLLUTION CONTROL
ADMINISTRATION

JANUARY 1970

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EFFECTS OF POLLUTION ON WATER QUALITY

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PERDIDO RIVER AND BAY
ALABAMA AND FLORIDA

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January 1970

U. S. Department of the Interior
Federal Water Pollution Control Administration
Southeast Water Laboratory
Technical Services Program
Athens, Georgia

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I. INTRODUCTION

On April 7, 1969, the Southeast Region of the Federal Water Pollution Control Administration received a request for technical assistance from the Director, Technical Staff, Alabama Water Improvement Commission in evaluating water quality conditions and waste sources in Perdido Bay. An investigation of waste sources and a detailed study of the bay and its major tributaries were conducted during the period of September 9-17, 1969. This report presents an evaluation of the data collected during this study.

The cooperation and contributions of various State, local, and private organizations are gratefully appreciated. Particular acknowledgments are due to personnel and students of the University of West Florida and to the Bureau of Sanitary Engineering of the Florida Department of Health and Rehabilative Services, the Florida Department of Air and Water Pollution Control, and the Alabama Water Improvement Commission.

II. CONCLUSIONS AND RECOMMENDATIONS

A. Conclusions

The St. Regis Paper Company located north of Pensacola in Cantonment, Florida discharges partially treated paper and pulp waste into Eleven Mile Creek at an average daily rate of approximately 27 million gallons per day. This volume constitutes most of the dry weather flow in Eleven Mile Creek.

The inadequately treated waste effluent from the St. Regis Paper Company at Cantonment, Florida is the major cause of the low dissolved oxygen, unsightly foam, excessive sludge deposits, and increased lignin in Perdido Bay and River, as well as degraded water quality in Eleven Mile Creek. Water quality problems in the mouth of Bayou Marcus are caused by the collective discharges to the bayou from six small treatment facilities, the most significant of which are the Mayfair, Montclair, and Avondale plants.

Dissolved oxygen in the north and northeast section of the bottom of Perdido Bay on both the Alabama and Florida sides is less than the 4.0 mg/l minimum value established by the states of Alabama and Florida for these waters, amounting to about 36% of the bottom waters of Perdido Bay north of Double Point, and the Perdido River for at least one mile above the entrance to the bay.

Residents in both Florida and Alabama have noted excessive amounts of unsightly brown foam on the shores of the bay and in the bay itself. This foam has been observed on the Alabama shore of Perdido Bay south of the U. S. 98 bridge.

About 86% of the bottom of Perdido Bay and the lower portion of the Perdido River is covered with sludge deposits containing organic carbon content in excess of 3.0%. These deposits exercise a major oxygen demand on the overlying water.

Concentrations of lignin-like compounds were from 1.5 to 14.0 times greater in Perdido Bay than in the Perdido River.

Water quality in Eleven Mile Creek is completely degraded and does not meet the criteria established by the State of Florida for industrial use, the stream's official classification.

The highest concentrations of oxygen demanding materials and lignin-like compounds were observed in the mouth of Eleven Mile Creek, whose flow consists primarily of the waste effluent from St. Regis. The average biochemical oxygen demand content of the wastes discharged from the St. Regis holding ponds is equivalent to a population of 330,000. This compares to a population equivalent of 840 discharged collectively from the six treatment plants on Bayou Marcus, Florida and 6,850 from the Perdido River above the tidal influence. St. Regis discharges 98% of the biochemical oxygen demand from all point sources to Perdido Bay including the Perdido River input.

Dye tracer studies have shown that wastes from Eleven Mile Creek reach the Alabama shore in flushing out of Perdido Bay. Wastes from Eleven Mile Creek are also carried into the Perdido River.

Chemical constitutents of foam and scum samples collected on both the Alabama and Florida shore were the same as those found in a water sample collected in Eleven Mile Creek. The effluent from

St. Regis is the source of the unsightly foam observed in Perdido Bay.

Comparison of organic carbon-organic nitrogen ratios of the sludge deposits in Perdido Bay show that they are primarily of paper mill waste effluent origin. St. Regis effluent is the major source of oxygen demanding sludge deposits in Perdido Bay. These sludge deposits, together with the suspended and soluble oxygen demanding material in the St. Regis effluent are the cause of the low dissolved oxygen concentrations in the bottom waters of Perdido River and Bay.

About 55% of the 193 pounds per day of total phosphate discharged to the bay is contained in the effluents from the six treatment plants on Bayou Marcus. These plants also discharge 73% of the 141 pounds per day of ortho phosphate, the form most readily assimilable by algae. St. Regis discharges the remaining 45% and 27% of total and ortho phosphates respectively.

Sewage and industrial wastes discharged to Eleven Mile Creek and Bayou Marcus in the State of Florida cause pollution of the interstate waters of Perdido River and Perdido Bay which endangers the health or welfare of persons living in the State of Alabama. These wastes are, therefore, subject to abatement under the provisions of Section 10 of the Federal Water Pollution Control Act (33 U.S.C. 466 et. seq.).

B. Recommendations

To abate the existing pollution in Perdido River and Perdido Bay, the following water quality management and waste abatement program is recommended as a minimum:

1) An overall removal efficiency of 90% for carbonaceous waste material from the St. Regis Paper Company. The St. Regis waste effluent, as measured below the present riffle terraces, not exceed 8,880 pounds per day of five-day BOD, and 2,610 pounds per day of total organic carbon. All settleable solids be removed.

2) The St. Regis Paper Company remove the foam causing constituents from its effluent.

3) The St. Regis Paper Company reduce the color of its waste discharge to levels not greater than background measured at the U. S. 90 bridge on the Styx and Perdido Rivers.

4) St. Regis Paper Company in cooperation with the Florida Department of Air and Water Pollution Control make a feasibility study of construction of an essentially closed system involving recirculation, treatment and reuse of its process water. This report shall be submitted to the Conferees by January 1, 1971.

5) The six sewage treatment plants on Bayou Marcus be consolidated into a central facility with removal efficiencies of 90% for carbonaceous material.

6) All waste abatement facilities be in operation by January 1, 1973.

III. AREA

The Perdido River basin extends over the eastern half of Baldwin County, Alabama, a small portion of the southwestern part of Escambia County, Alabama, and the western portion of Escambia County, Florida. The basin lies about half in Alabama and half in Florida, and the Perdido River forms the boundary between the two states.

The Perdido River rises near the town of Bay Minette in the southern part of Alabama and flows generally south about 60 miles toward the Gulf of Mexico where it empties into Perdido Bay. It drains an area of approximately 925 square miles. The main tributaries are Dyas Creek, Brushy Creek, Styx River and Blackwater River. The Styx River is the largest of these and has a drainage area of 259 square miles. Wolf Creek and Wolf Bay lie adjacent to this basin in Alabama.

The principal municipalities in the river basin with their 1960 populations are: Atmore, 8,173; Bay Minette, 5,197; Foley, 2,889; and Robertsdale, 1,474; all in Alabama.

Flow in the Perdido River is measured at the U. S. Geological Survey gage southwest of Barrineau Park, Escambia County, Florida. For the period of record, June 1941 through September 1966, the mean discharge is 760 cubic feet per second (cfs) with a maximum for this period of 39,000 cfs and a minimum of 207 cfs.

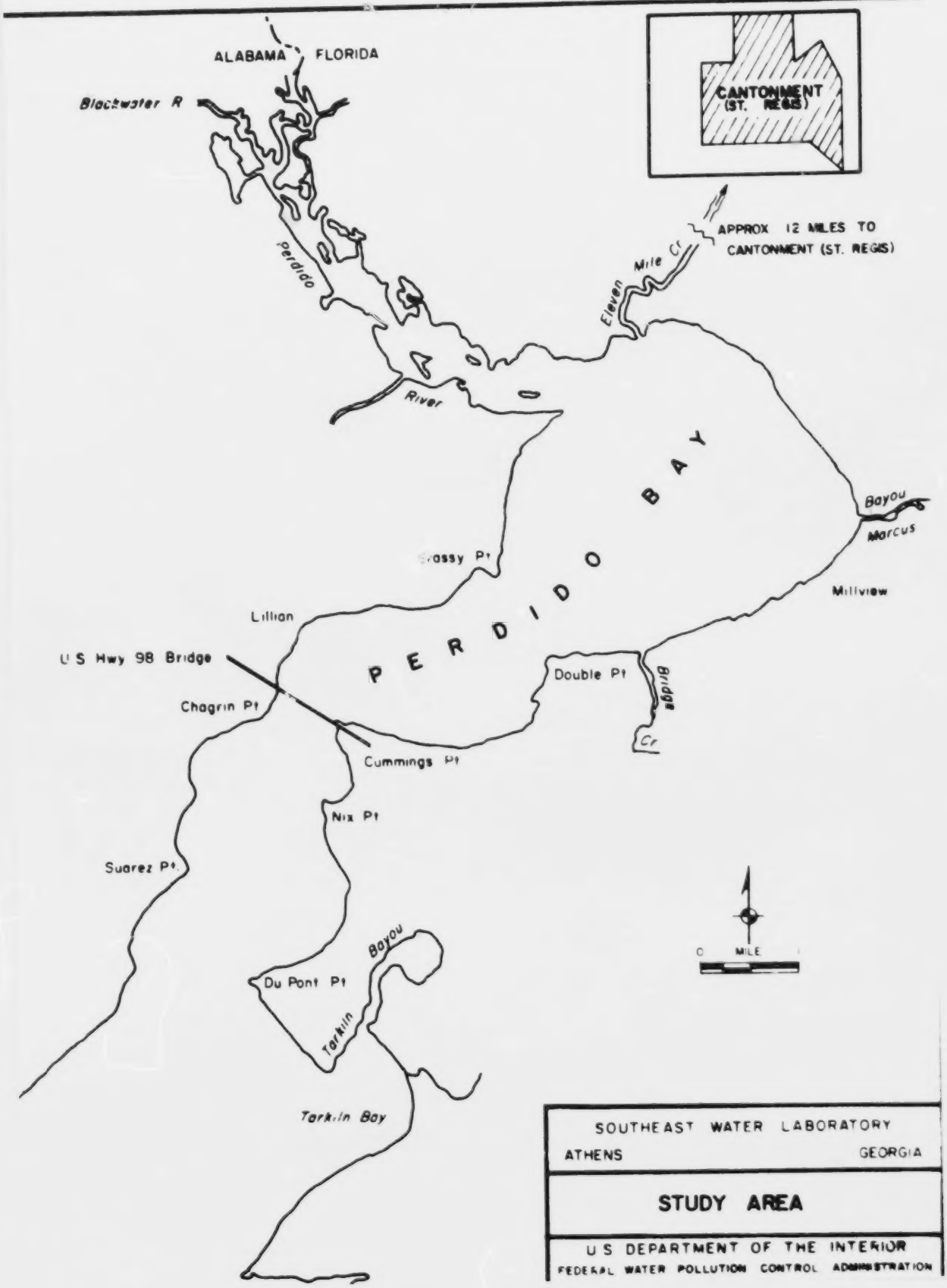
In addition to the Perdido River, two minor tributaries empty directly into upper Perdido Bay. These are Eleven Mile Creek and Marcus Bayou. The St. Regis Paper Company located north of Pensacola in Cantonment, Florida discharges partially treated paper and pulp

waste into Eleven Mile Creek at an average daily rate of approximately 27 million gallons per day. This volume constitutes most of the dry weather flow in Eleven Mile Creek. The property through which the creek flows is owned entirely by the St. Regis Paper Company. Marcus Bayou is a minor tributary which drains an area from Perdido Bay to a point west of Pensacola, Florida. Flows from Marcus Bayou for two years of record ranged from 30 to 170 cfs with a mean of approximately 42 cfs. Much of this region has been recently developed with residential sub-divisions, and, as a result, six small domestic sewage treatment plants now discharge treated waste into Marcus Bayou.

Perdido Bay is a long narrow body of water about two to three miles in width, and about 13 miles in length from the upper bay headwaters to the mouth on the Gulf of Mexico. The upper bay, north of the U. S. 98 bridge, is generally fairly shallow, averaging less than seven feet in depth. In the lower bay the depth increases to about nine to 10 feet. The entire bay, and the lower six to seven miles of the Perdido River are subject to tidal variation with a pronounced salt water intrusion zone near the bottom of the estuary. The study area is shown in Figure 1.

The climate of the area is mild with summer temperature about 80°F, and winter temperature averaging about 55°F. The average annual rainfall is 62 inches with March, July, August and September being the wettest months and October and November the driest. Thunderstorms of high intensity are common with as much as three to four inches of rainfall during a one hour period.

FIGURE 1



SOUTHEAST WATER LABORATORY
ATHENS GEORGIA

STUDY AREA

U S DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION

During the field survey period, the weather was generally warm and clear. Average daily temperatures ranged from 71° to 80°F, maximum temperatures from 81° to 89°F, and minimum temperatures from 60° to 74°F. Only trace precipitation was measured from September 7 to September 18, 1969, at the Pensacola airport. Winds during the study period were generally calm, averaging between 6.4 and 9.8 miles per hour (mph) and maximum wind velocities during the period were less than 16 mph. Wind direction was primarily from the north and east. The field survey period was generally partly cloudy with sky cover ranging from a daily mean of 20% to 80%. Morning fog with smoke or haze was observed on nearly every day. Tidal range for the period varied from about 0.6 feet on September 13, 1969, to over 1.7 feet on the 17th of September. A tidal cycle in Perdido Bay generally has about a 25-hour duration. Discharge measurements for the Perdido River during the field survey are listed in Table 1. Flows were below mean discharge levels ranging between 310 and 382 cfs at the Barrineau Park gauge. No direct measurement of flows from Eleven Mile Creek and Marcus Bayou were performed during the survey.

TABLE 1

PERDIDO RIVER FLOW
BARRINEAU PARK, FLORIDA

September 9-17, 1969

DATE	AVG. DAILY FLOW (cfs)
September	
9	382
10	358
11	350
12	332
13	32[illegible]
14	318
15	312
16	306
17	310

IV. WATER USE CLASSIFICATION

Perdido Bay has been classified by the State of Florida as Class III -- Recreation, Propagation, and Management of Fish and Wildlife.

Water quality requirements for this category are:

(1) Sewage and industrial wastes shall receive modern, effective treatment; this is interpreted by the State of Florida as requiring at least 90% removal of organic matter.

(2) Receiving waters shall not be caused to vary more than one unit on the pH scale from the normal background pH level. In no case will pH be less than 6.0 or greater than 8.5.

(3) Dissolved oxygen levels shall not be artifically depressed below 4.0 mg/l.

(4) Bacteria of the coliform group shall not exceed 1,000 per 100 ml as a monthly average (MPN or MF) nor exceed this value in more than 20% of the samples examined per month, nor shall it exceed 2,400 per 100 ml on any day.

(5) No substances shall be present which are toxic or harmful to humans, animal or aquatic life.

(6) The waters shall be free from materials attributable to municipal, industrial, agricultural or other discharges producing color, odor, or other conditions in such degree as to create a nuisance.

(7) Turbidity shall not exceed 50 Jackson units above background.

(8) Temperature shall not be increased so as to cause damage to aquatic life or vegetation of the receiving waters or interfere with any beneficial use assigned to such waters.

The State of Alabama has classified Perdido Bay for Swimming, Shellfish Harvesting and Fish and Wildlife. The criteria for these uses are similar to Florida's; however, bacterial concentrations for shellfishing use shall not exceed the limits specified in the National Shellfish Sanitation Program Manual of Operations; Sanitation of Shellfish Growing Areas. These limits specify that total coliform bacteria may not exceed a median value of 70 per 100 ml (MPN) nor more than 230 per 100 ml in 10% of the samples measured under the most unfavorable hydrographic and climate conditions. Perdido Bay is not presently approved for shellfish harvesting.

The State of Florida has classified Eleven Mile Creek for navigation, utility and industrial use. The salient criterion for this use is that dissolved oxygen shall not be less than 1.0 milligram per liter (mg/l) with an average value of not less than 2.0 mg/l. It is the intent of the State of Florida to review Class V stream classifications periodically as often as necessary, and as water quality of such areas improves, hearings will be held and reclassification shall be established. It is expected that in all instances presently classified as Class V waters, there shall be decided and definitive enhancement not later than January 1, 1973.*

*Plan of Implementation and Enforcement of Florida's Water Quality Standards and Stream Classifications (Rule 28-5.01).

V. WASTE DISCHARGES

The major organic waste source discharging to Perdido Bay is the St. Regis Paper Company. Minor quantities of waste are contributed via the Perdido River from upstream Alabama sources and by six small domestic sewage treatment plants which discharge to Bayou Marcus. These plants include: Montclair sewage treatment plant; Mayfair sewage treatment plant; the West Pensacola Utilities Avondale Plant; Devonshire sewage treatment plant; Fairway Mobile Homes package plant; and the Naval Air Station's Saufley Field plant.

Organic Wastes

The effects of organic waste effluents on quality of the receiving waters can be characterized by the carbon, nitrogen and phosphorus content. These three substances have both direct and indirect effects on the dissolved oxygen distirbution. Adequate levels of dissolved oxygen are essential to the maintenance of fish and other aquatic life. High concentrations of oxygen demanding material will cause an excessive reduction of the dissolved oxygen resources which, in turn, will result in a reduction of desirable aquatic life and fish population. If the wastes are strong enough to cause a complete depletion of the dissolved oxygen, offensive odors will result. A summary of data collected during the period September 9-18, 1969 is presented in Table 2.

Biochemical oxygen demand (BOD) is a measure of the quantity of oxygen that will be used in stabilizing the waste material in a stated period of time. The values presented are for a five-day

TABLE 2

SUMMARY OF WASTE DISCHARGES

Source	5 day BOD		Kjeldahl-N		NH_3-N		NO_2-NO_3-N		T. Phosphate****		O. Phosphate****		TOC*		TOD**	
	#/da	%***	#/da	%	#/da	%	#/da	%	#/da	%	#/da	%	#/da	%	#/da	%
St. Regis Company (below riffle terraces)	55260	99.7	413	71.9	11	6.8	1	3.1	87	45.1	38	25.8	16,150	99.1	45140	97.5
Fairway Mobile Home Ct.	0.03	<0.01	0.13	<0.01	0.43	0.2	0.002	<0.01	0.20	0.1	0.22	0.14	0.43	<0.01	2	<.01
W. Pensacola Utl. (Avondale)	26	<0.01	20	3.4	19	11.8	0.03	<0.01	22	11.4	20	13.6	47	0.3	218	0.5
Montclair STP	37	<0.01	96	16.7	86	53.4	24	75.0	54	28.0	53	36.1	74	0.5	639	1.4
Devonshire STP	1	<0.01	3	0.5	2	1.2	3	9.4	3	1.6	3	2.0	2	<0.01	18	0.03
Mayfair STP	24	<0.01	42	7.3	42	26.1	3	9.4	27	14.0	27	18.4	28	0.02	267	0.6
Saufley Field STP	53	<0.01	0.24	0.04	0.18	0.1	1	3.1	0.06	0.03	0.006	<0.01	2	<0.01	6	<0.01
STP Total	141	0.3	161	28.0	150	93.2	31	96.8	106	54.9	103	70.1	153	0.9	1150	2.5
TOTAL	55400	100	574	100	161	100	32	100	193	100	141	100	16300	100	46290	100

*Total organic carbon
**Theoretical Oxygen Demand
***Percent of total discharged by waste sources in the study area.
****as P

period. The total organic carbon (TOC) is a direct measure of organic carbon, and each pound of TOC discharged requires 2.67 pounds of oxygen during stabilization to carbon dioxide. Total Kjeldahl nitrogen (TKN) is the sum of the total unsatisfied nitrogen as both nitrogen and ammonia. Each pound of this material requires 4.57 pounds of oxygen during stabilization to nitrates. A measure of the total amount of oxygen in the receiving water which is necessary to completely stabilize the unoxidized carbonaceous and nitrogenous content of the waste discharge is the theoretical oxygen demand (TOD) and is expressed according to the equation:

$$TOD = 2.67\ (TOC) + 4.57\ (TKN) \qquad (1)$$

where:

TOD = theoretical oxygen demand

TOC = total organic carbon

TKN = total Kjeldahl nitrogen

This relationship presumes that all of the carbon will eventually be oxidized to carbon dioxide and all of the unstabilized nitrogen to nitrates.

Phosphorus is a growth requirement for aquatic plants. Excessive phosphorus in the receiving water could either directly or indirectly stimulate excessive and undesirable populations of plankton and thereby upset the ecological balance among competing species. The ortho phosphate form is that which is most readily acceptable for assimilation by plankton.

A. St. Regis Paper Company

The St. Regis Paper Company operates a bleached Kraft paper mill in Cantonment, Florida, north of Pensacola. The plant discharges an average of 27 million gallons per day (MGD) of pulp and bleach waste into holding ponds. An average 38% reduction in five day BOD was observed in the pond area, reducing the daily waste output from 88,800 pounds (523,000 population equivalents (P.E.)*) to 55,000 pounds (330,000 P.E.). After leaving the ponds, the effluent is channeled through a man made riffle terrace which aerates the waste. The waste below the terraces is deep brown to black in color and the surface of the water is largely covered by a blanket of light brown foam which is the result of passage over the riffle terrace. The channel leads into Eleven Mile Creek, which, at this point, entirely consists of St. Regis waste.

Eleven Mile Creek flows for a distance of about 12 to 13 miles directly into Perdido Bay. The creek and the property through which it flows are owned by the St. Regis Paper Company. During the field survey an average of 33,700 pounds per day (202,000 P.E.) of five day BOD was observed at the Route 184 bridge and 27,400 pounds per day (165,000 P.E.) were measured at Route 90, about four miles above the bay. Dissolved oxygen in Eleven Mile Creek was essentially absent and does not meet the criterion officially established by Florida for navigation, utility, and industrial use.

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* One five day BOD population equivalent = 0.17 pounds per day

Total Kjeldahl nitrogen and ammonia nitrogen concentrations in Eleven Mile Creek below the riffle terrace were 413 and 11 pounds per day respectively. This quantity represents approximately 71.9% of the Kjeldahl nitrogen and 3.1% of the ammonia nitrogen discharged from all point sources in the study area. Inorganic nitrogen (nitrite + nitrate) was almost negligible in the St. Regis effluent. Average daily discharge of nitrite plus nitrate nitrogen was about one pound per day. The discharge of organic and inorganic nitrogen from St. Regis is equal to a P.E. of 16,710.*

The total phosphate contribution from St. Regis was 87 pounds per day, of which 38 pounds were in the ortho form, representing about 45% of the total phosphate and one quarter of the ortho phosphate discharged in the study area. This quantity is equivalent to a population of 10,600.**

St. Regis discharges 97.5% of the theoretical oxygen demand produced in the study area, amounting to over 45,140 pounds per day. The TOC, as previously noted, is composed of both organic carbon and Kjeldahl nitrogen and provides some evidence of the total oxygen demand of the waste. Most of the TOD discharged is in the form of carbon with less than 1% of the total resulting from the nitrogen input. Total organic carbon discharge from St. Regis below the riffle terraces amounted to 16,150 pounds per day while Kjeldahl nitrogen was 413 pounds per day.

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* 1 total nitrogen P.E. = 9 pounds per year

** 1 total phosphate P.E. = 3 pounds per year

Color in the St. Regis effluent was 1,400 units. The St. Regis Company has received a research grant from FWPCA to develop an efficient color removal process for its waste water. Results from this research are required by January 1, 1973.

B. Bayou Marcus

Six small sewage treatment plants discharge domestic waste into Bayou Marcus which enters Perdido Bay on its northeastern shore. These facilities include:

(1) Montclair sewage treatment plant - A modified trickling filter plant with a sludge digestion system. Settling ponds are also utilized for "polishing" the effluent (0.525 mgd).

(2) Mayfair sewage treatment plant - A secondary trickling filter plant (0.175 mgd).

(3) West Pensacola Utilities (Avondale) - Primary treatment plant with settling ponds (0.175 mgd).

(4) Devonshire sewage treatment plant - Package aeration plant (0.017 mgd).

(5) Fairway Mobile Home Court - Small package aeration plant (0.004 mgd).

(6) Saufley Field (NAS) sewage treatment plant - Small primary plant (0.21 mgd).

The total discharge from all six plants amounts to 1.1 million gallons per day. The six plants combined discharge 0.3% of the total five-day BOD (141 pounds per day). Nitrogen and phosphate compounds discharged from these six plants constitute a significant

proportion of the total. During the survey 28% of the Kjeldahl nitrogen (161 pounds per day), 93.2% of the ammonia nitrogen (150 pounds per day), 96.8% of the nitrite-nitrate nitrogen (31 pounds per day), 54.9% of the total phosphate (106 pounds per day), and 70.1% of the ortho phosphate (103 pounds per day) resulted from these six sources. These discharges are collectively equivalent to 7,800 P.E. of total nitrogen and 18,600 P.E. of total phosphate.

Montclair is the largest of the six treatment plants. The plant discharges over 0.5 mgd of domestic sewage with secondary treatment and sludge digestion. The BOD measured at the plant outfall indicated a daily discharge of 37 pounds (222 P.E.). The total organic carbon discharged was 74 pounds per day, which is more than half of the total of the six plants discharging to Bayou Marcus. Total Kjeldahl nitrogen discharge was 96 pounds per day of which 86 pounds were in the ammonia form. Nitrites and nitrates were measured at 24 pounds per day which constitutes 75% of all of the inorganic nitrogen discharged from point sources in the study area. The nitrogen P.E. for this plant is 7,300. Significant quantities of phosphate compounds are also discharged from the Montclair Plant amounting to 54 pounds per day and 53 pounds per day of total and ortho phosphates respectively. This quantity represents 28% of all the phosphates discharged in the study area and is equal to a P.E. of 6,570.

C. Perdido River

The municipalities of Atmore, Bay Minette, Foley, and Robertsdale, Alabama, are located in the Perdido drainage basin with a combined population of about 17,000 based on the 1960 census. The Newport Division, Tenneco Chemicals, Inc. is located at Bay Minette. Pine tar resin extraction is performed. Atmore, Foley, and Robertsdale provide secondary treatment for sewage. Bay Minette provides primary treatment. No treatment is given the industrial waste from Tenneco.

Biochemical oxygen demand was measured at two locations in the Perdido River above the tidal influence. Both locations (Florida Highway 184 and U. S. Highway 90) had a mean five day BOD of 0.6 mg/l. This level of BOD is not significantly above unpolluted stream background concentrations. On a mass basis, the five day BOD of the Perdido River was 1140 pounds per day. The population equivalent of five day BOD in the Perdido River was 6850. If this source of five day BOD was added to those previously noted in the study area, the total input from all sources is about 337,700 P.E. of which about 2% would be attributable to the Perdido River.

In summary, St. Regis contributes 99.7% of the five day BOD, 97.5% of the TOD, 71.9% of the total Kjeldahl nitrogen, 99.1% of the total organic carbon and 45.1% of the total phosphate discharge from all point sources of waste in the study area exclusive of the input from the Perdido River.

VI. WATER QUALITY

1) Current Movement

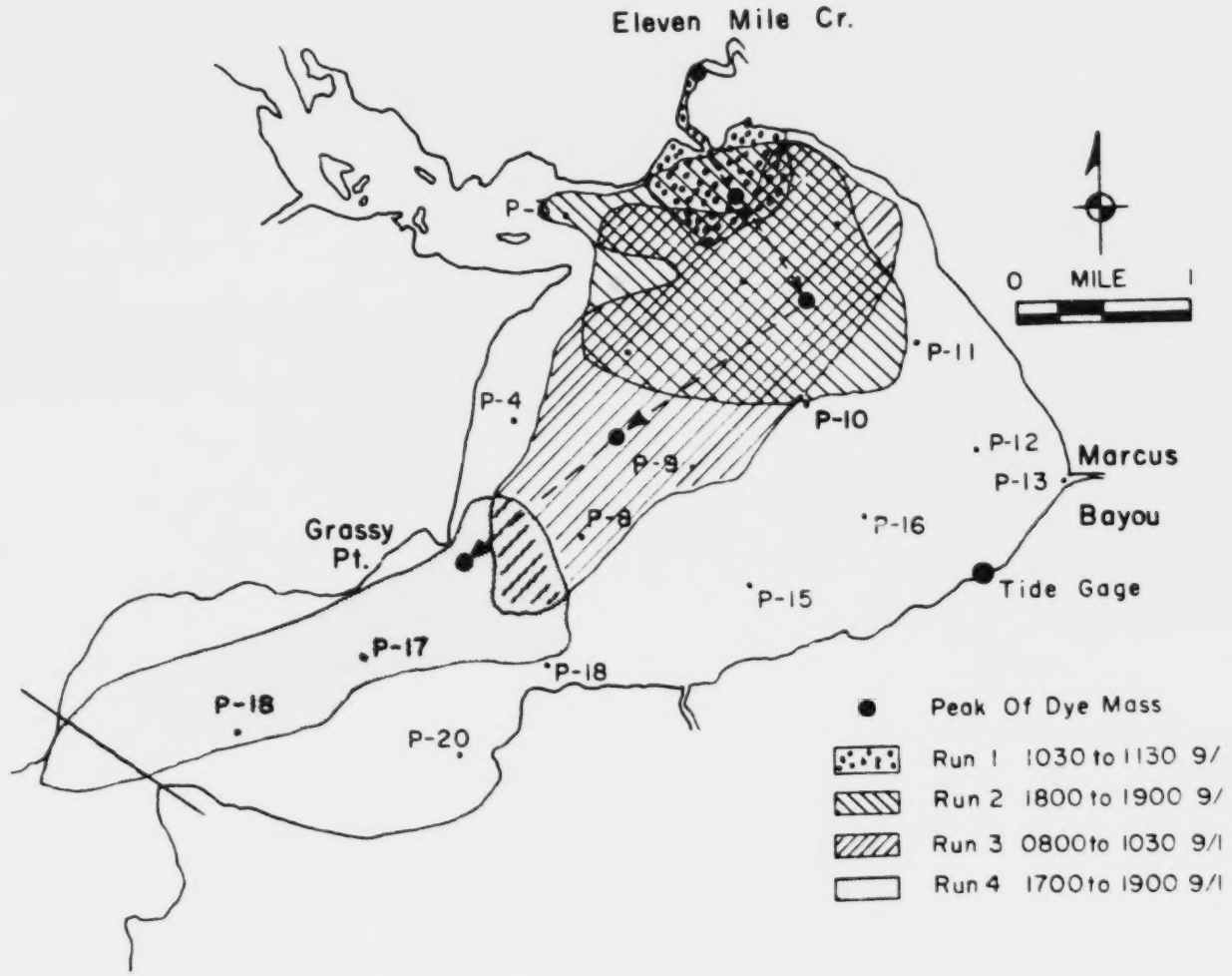
Water movement and the distribution of wastes discharged to Perdido Bay were evaluated by dye tracer studies and by examining chloride concentrations in the bay.

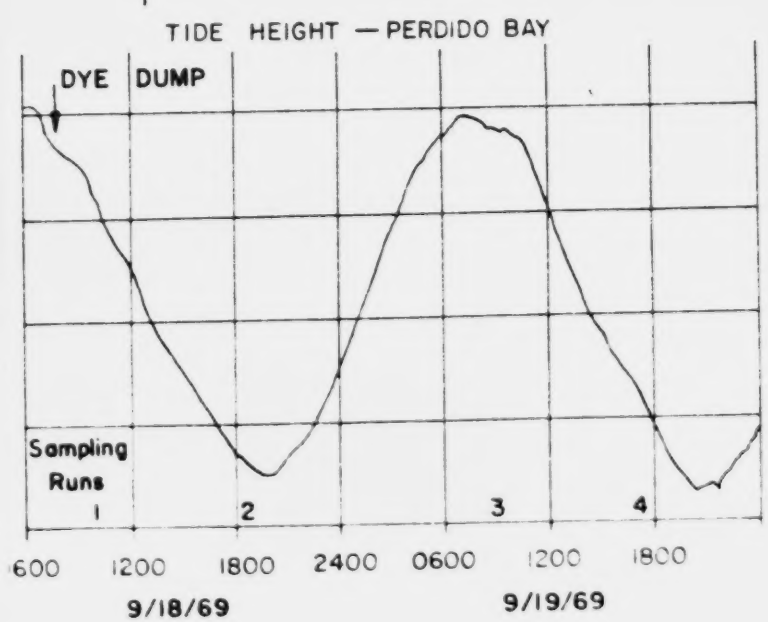
Rhodamine WT fluorescent dye was used as the tracer during the study. It is not found in natural bodies of water and does not decay significantly with time. Therefore, changes in its concentration are due to tidal diffusion and advection caused by flow from the Perdido River and other tributaries of Perdido Bay.

A profile of the distribution of dye in Perdido Bay is presented in Figure 2. Dye was injected into Eleven Mile Creek, approximately one mile above the mouth, on the beginning of an ebbing current at 7:30 a.m. on September 18, 1969. Between 10:30 and 11:00 a.m., near the time of the maximum ebbing current, the center of the mass of dye had traveled 0.4 mile in a southeasterly direction. The entire dye mass spread to one-half mile on each side of Eleven Mile Creek and dye concentrations were approximately the same at each depth.

At the low water slack current, the center of the dye mass had traveled about one mile southeast of the mouth of Eleven Mile Creek and the body of the dye mass spread over most of the section of Perdido Bay north of station P-10 (see Figure 2). Dye was also observed in the Perdido River. This indicates that waste from

FIGURE 2 18a





DYE DISTRIBUTION
IN
PERDIDO BAY

Eleven Mile Creek does enter the Perdido River. During the next high water slack current, the peak of the dye mass was located approximately two miles southwest of the mouth of Eleven Mile Creek. The mass of dye at this time was oblong in shape and most of the dye was located in the Alabama portion of the upper bay.

On the next low water slack current the highest dye concentrations were observed off Grassy Point on the Alabama shore. Most of the dye was located on the Alabama side of the bay between Grassy Point and the U.S. 98 bridge. The concentration of dye was generally uniform with depth.

In summary, waste discharged by the St. Regis Paper Company into Eleven Mile Creek ultimately is transported into the Alabama portion of Perdido Bay. This transport is accomplished principally by advection caused by flow from the Perdido River. The tracer study also indicated that waste was generally distributed uniformly from surface to bottom and that waste from Eleven Mile Creek penetrates into the Perdido River.

Since chlorides are inorganic and do not decay with time, examination of the chloride profiles in an estuary provides information on water movement and waste distribution. The only factors which could cause variations in chloride concentration at a particular point, are turbulent dispersion due to the tidal currents and, advection caused by fresh water inflow principally from the Perdido River. The volume of this fresh water inflow as well as the physical configuration of the bay also determine the amount of time it takes to flush wastes from Perdido Bay.

Figures 3 and 4 show the predominant current patterns in Perdido Bay derived from chloride analyses at 25 locations, collected ten times at each location synoptically, during the period September 9-17, 1969.

On the flooding current, water from the Perdido River disperses in a southerly direction on the surface of the western portion of Perdido Bay. Some water from Bayou Marcus flows south on the surface along the eastern shore of the bay and surface water from Eleven Mile Creek mixes with the eastern edge of the flow from the Perdido River. On the bottom, saline water flows northeasterly from the lower bay on the western shore, until at Grassy Point, it crosses to the eastern shore. Just west of Bridge Creek, the saline water from the Gulf begins to flow in a northerly direction and then in a westerly direction along the northern shore into the lower depths of the Perdido River. Bottom flow from Bayou Marcus was north along the eastern shore of the bay and flow from the bottom of Eleven Mile Creek was carried by the saline water into the Perdido River.

On the ebbing current, water from the Perdido River is only slightly dispersed as it flows south on the surface and bottom along the central and western shores of the bay. Discharge from Eleven Mile Creek combines with the flow from the Perdido River. Flow from Bayou Marcus is south along the eastern shore of the bay. The more saline water on the bottom recedes slightly along the eastern half of the upper bay.

FIGURE 3

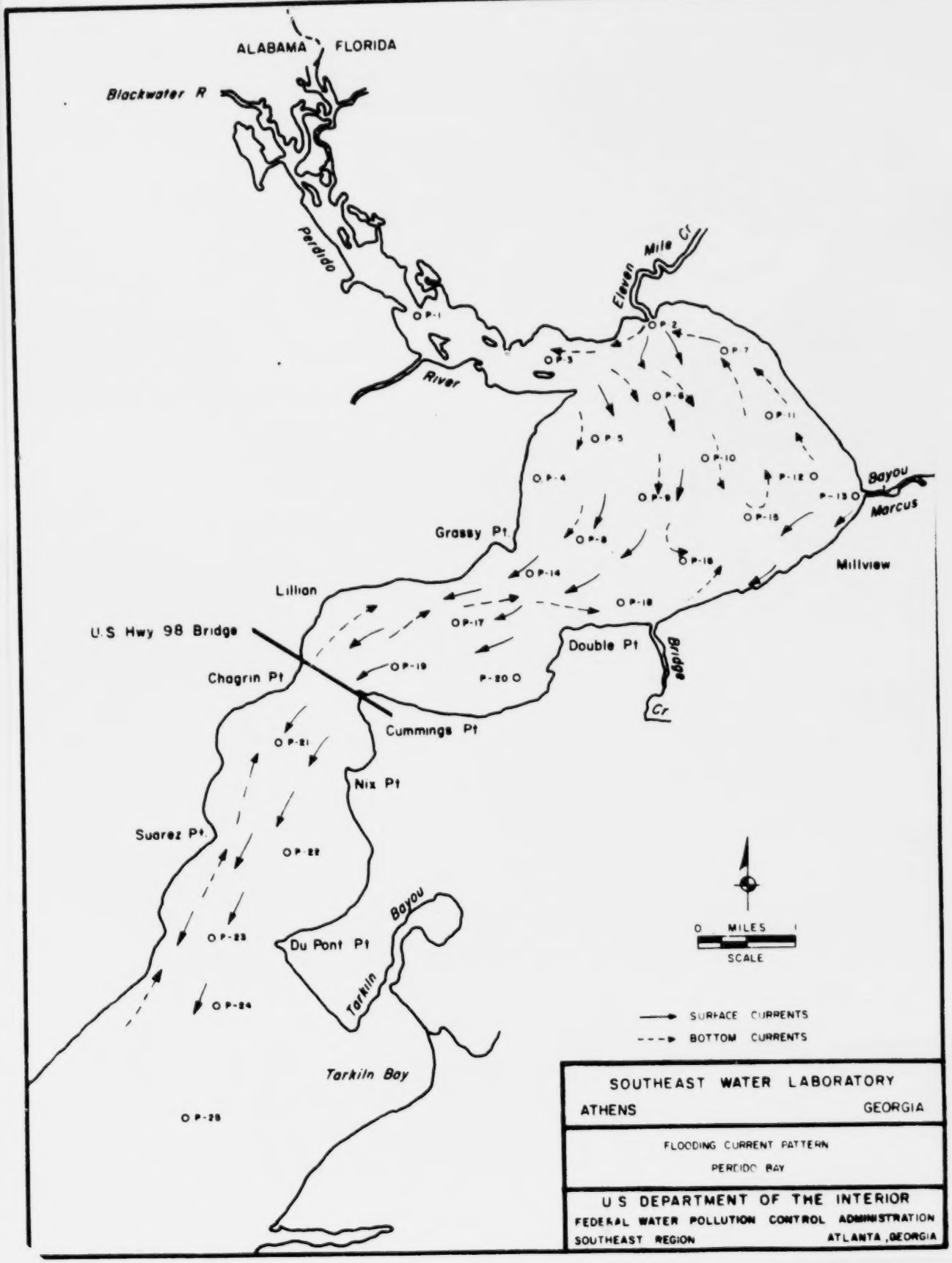
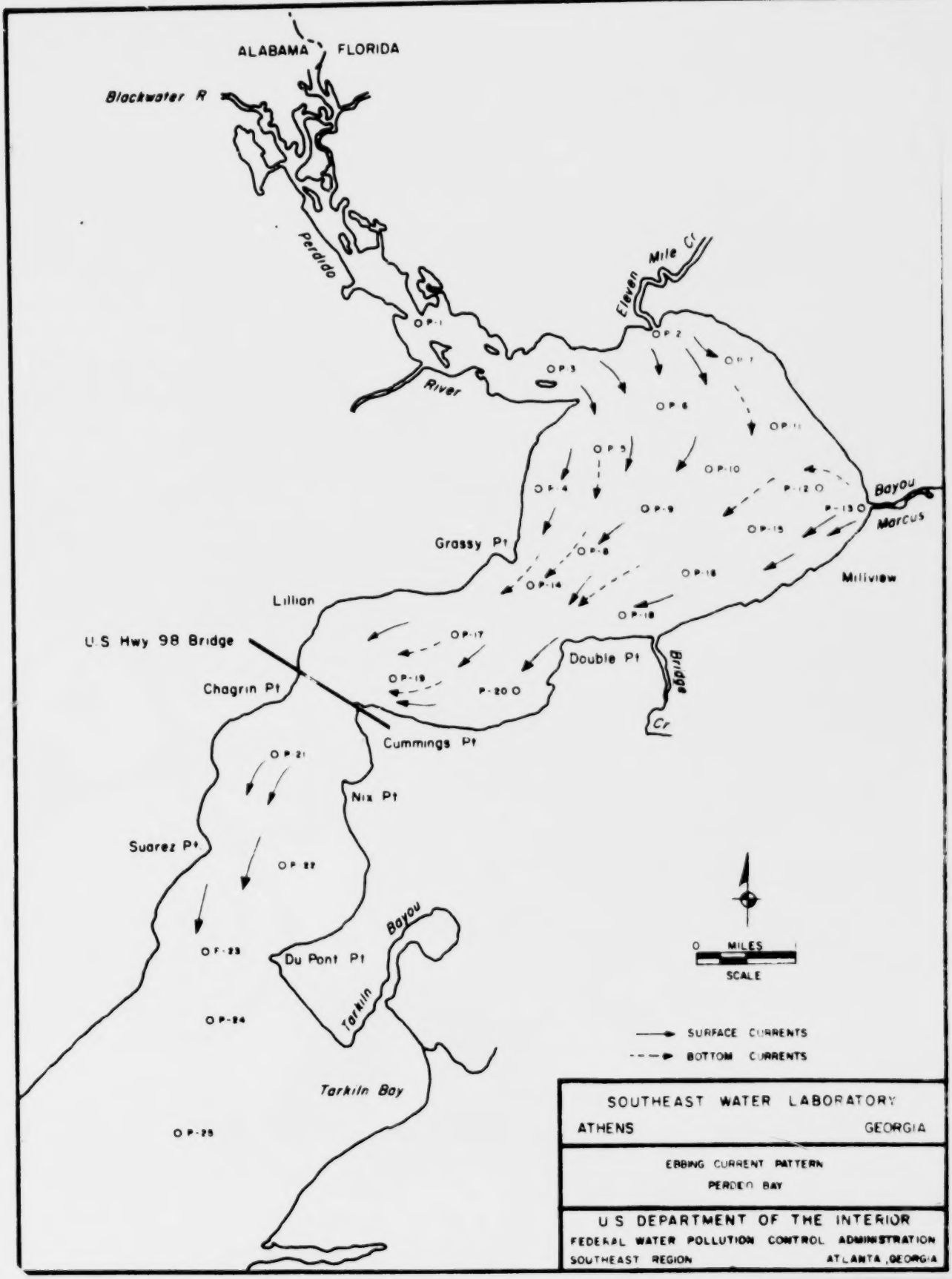

ALABAMA
FLORIDA
Blackwater R
Perdido
River
Eleven Mile Cr
P-1
P-2
P-3
P-4
P-5
P-6
P-7
P-8
P-9
P-10
P-11
P-12
P-13
P-14
P-15
P-16
P-17
P-18
P-19
P-20
P-21
P-22
P-23
P-24
P-25
Grassy Pt
Lillian
U.S Hwy 98 Bridge
Chagrin Pt
Cummings Pt
Nix Pt
Suarez Pt
Du Pont Pt
Bayou
Tarkiln
Tarkiln Bay
Bayou Marcus
Millview
Double Pt
Bridge Cr
0 MILES 1
SCALE
SURFACE CURRENTS
BOTTOM CURRENTS
SOUTHEAST WATER LABORATORY
ATHENS GEORGIA
FLOODING CURRENT PATTERN
PERDIDO BAY
U S DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
SOUTHEAST REGION ATLANTA, GEORGIA

FIGURE 4


ALABAMA
FLORIDA
Blackwater R
Perdido
River
Eleven Mile Cr
OP-1
OP-2
OP-3
OP-4
OP-5
OP-6
OP-7
OP-8
OP-9
OP-10
OP-11
P-12
P-13
OP-14
OP-15
OP-16
OP-17
OP-18
P-20
OP-21
OP-22
OP-23
OP-24
OP-25
Grassy Pt
Lillian
U.S Hwy 98 Bridge
Chagrin Pt
Cummings Pt
Nix Pt
Suarez Pt
Du Pont Pt
Tarkiln Bayou
Tarkiln Bay
Double Pt
Bridge Cr
Bayou Marcus
Millview
0 MILES 1
SCALE
SURFACE CURRENTS
BOTTOM CURRENTS
SOUTHEAST WATER LABORATORY
ATHENS GEORGIA
EBBING CURRENT PATTERN
PERDIDO BAY
U S DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
SOUTHEAST REGION ATLANTA, GEORGIA

In general, currents in Perdido Bay are weak and circulation is poor. However, the predominant current patterns indicate that circulation is counterclockwise in the northern portion of the bay with fresh water flowing south along the Alabama shore of the bay and saline water advancing along the Florida shore. The eastern third of the upper bay is very shallow and generally exhibits extremely poor circulation; as do the embayments between Double and Cummings Points, and Cummings and DuPont Points.

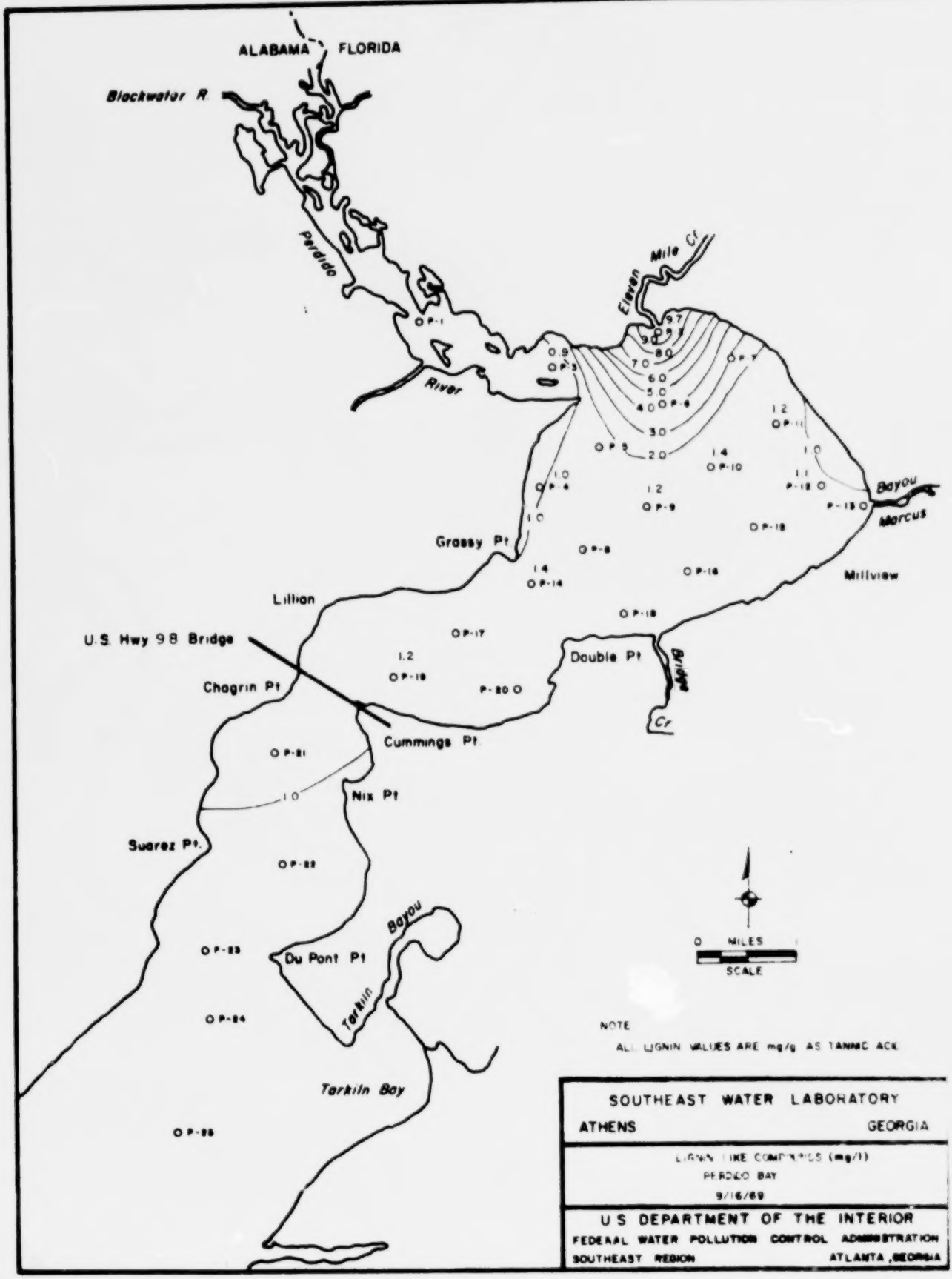
2) Lignin

Lignin is, after cellulose, the principal constituent of the woody structure of higher plants. Since wood is the principal raw material used in the manufacture of paper pulp and only residual amounts of lignins remain in the pulp after the cooking operation, lignins are a major constituent of paper mill waste. For this reason, the lignin concentrations in Perdido Bay were measured to trace the distribution of waste discharged by the St. Regis Paper Company (Figure 5).

The highest concentration observed in the bay was 9.7 mg/l at the mouth of Eleven Mile Creek. As Eleven Mile Creek discharges into the bay, lignins undergo relatively rapid dilution to about 1.2 mg/l, the average concentration of most of the upper bay. The lowest concentration observed was 0.7 mg/l at station P-1 in the Perdido River.

Based upon lignin concentrations, wastes from St. Regis Paper Company undergo relatively rapid dilution in Perdido Bay and concentrations diminished gradually in the lower bay.

FIGURE 5


ALABAMA
FLORIDA
Blackwater R.
Perdido
River
Eleven Mile Cr
Bayou Marcus
Millview
Grassy Pt
Lillian
U.S. Hwy 98 Bridge
Chagrin Pt
Cummings Pt
Nix Pt
Suarez Pt
Double Pt
Bridge Cr
Du Pont Pt
Bayou Tarkiln
Tarkiln Bay
P-1
P-2
P-3
P-4
P-5
P-6
P-7
P-8
P-9
P-10
P-11
P-12
P-13
P-14
P-15
P-16
P-17
P-18
P-19
P-20
P-21
P-22
P-23
P-24
P-25
0 MILES 1
SCALE
NOTE
ALL LIGNIN VALUES ARE mg/g AS TANNIC ACID
SOUTHEAST WATER LABORATORY
ATHENS GEORGIA
LIGNIN LIKE COMPOUNDS (mg/l)
PERDIDO BAY
9/16/69
U S DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
SOUTHEAST REGION ATLANTA, GEORGIA

Lignin-like compounds impart a brown to black color in paper process waste effluent. Color measurement performed on the same samples analyzed for lignins indicated a similar distribution of values, ranging from 100 units at the mouth of Eleven Mile Creek to 27 units at Station P-23 in the lower bay. All color concentration in Perdido Bay were found to be above background levels in the Styx River. Color in the Styx River at Highway 90 was 25 units. Color in the St. Regis effluent was 1,400 units.

3) Foam

Although only isolated patches of foam were observed on Perdido Bay during the September 1969 survey, residents of the area have observed large quantities of foam around the shoreline and in the bay.

On September 12 and 16, 1969, foam samples from Perdido Bay and effluent samples from Eleven Mile Creek were collected. Resin acids, together with fatty acids, form the principal constituent of the tall oil produced as a by-product of the sulfate pulping process. Pimaric, isopimaric and dehydroabietic acid are the types of resin acids found in paper mill waste.

Pimaric, isopimaric and dehydroabietic acid were found in a sub-surface sample from Eleven Mile Creek (Table 3). Three samples were collected from the Florida shore of upper Perdido Bay near Horns Cottages on Millview Drive. The first sample contained only foam collected from the end of a small beach. The second sample consisted of foam and a scum which was floating on the surface. The concentrations of each of the three resin acids in the scum were less than half of

TABLE 3

RESIN ACIDS - PERDIDO BAY

Location	Date	Type of Sample	Pimaric Acid (mg/l)	Isopimaric Acid (mg/l)	Dehydroabietic Acid (mg/l)
Eleven Mile Creek	9/16/69	Sub-surface	0.7±0.2*	0.4±0.1	1.3±0.3
Horns Cottages Millview Dr. Florida	9/12/69	Foam	1.5±0.4	1.8±0.4	2.0±0.5
	9/12/69	Foam & Scum	0.6±0.15	0.4±0.1	0.9±0.2
	9/12/69	Sub-surface	None	None	None
Perdido Beach Alabama	9/16/69	Foam	0.7±0.2	1.6±0.4	1.6±0.4

*Because of emulsion problems encountered during extraction there was some loss of sample which is accounted for by reporting a range for the concentrations found.

the quantity found in the foam alone. A subsurface sample was also collected at this location and no resin acids were detected.

Another foam sample was collected on the Alabama shore of lower Perdido Bay near Perdido Beach, Alabama. Concentration of pimaric and dehydroabietic acid approximately equal to those in Eleven Mile Creek were found. In addition, four times as much isopimaric acid as was observed in the Eleven Mile Creek sample was present.

Resin acids from paper mill waste discharged by the St. Regis Paper Company concentrate in the surface layer of Perdido Bay water and their presence is manifested in foam due to turbulence and winds in the bay. The dye tracer studies previously discussed have demonstrated that wastes from St. Regis reach the Alabama shore. The source of the unaesthetic excessive foaming in Perdido Bay reported by residents of both Alabama and Florida is the inadequately treated wastes from the St. Regis Paper Company.

4) Total Organic Carbon

Organic carbon is a primary food supply for bacteria which consume oxygen in the biodegradation process. The end products are carbon dioxide and bicarbonates which are utilized by algae in their growth process. Excessive quantities of organic carbon, accompanied by an adequate supply of nitrogenous compounds and phosphorus, ultimately may produce accelerated eutrophication. Suspended organic carbon compounds will settle to the bottom producing sludge beds which exert a long term oxygen demand.

Total organic carbon concentrations were extremely high throughout the upper bay, ranging from 4 mg/l near the U.S. 98 bridge to over 13 mg/l at both the mouths of Eleven Mile Creek and Bayou Marcus (Figure 6). The mean concentration of total organic carbon in the mouth of the Perdido River was 4.5 mg/l. The average TOC concentration in Perdido Bay is about 7 mg/l.

5) Nitrogen

The maximum concentrations of total Kjeldahl nitrogen are in the north and northeast sections of the bay in the vicinity of Eleven Mile Creek and Bayou Marcus (Figure 7). These mid-depth values are approximately two to three times greater than other parts of Perdido Bay. The maximum mean value of 0.74 mg/l was observed in the mouth of Eleven Mile Creek. The next highest concentration of 0.31 mg/l was observed in the mouth of Bayou Marcus. The concentrations of 0.16 mg/l in the mouth of the Perdido River and south of the U. S. 98 bridge were below these levels, indicating that Eleven Mile Creek and Bayou Marcus are sources of Kjeldahl nitrogen to Perdido Bay.

Ammonia nitrogen concentrations averaged about 0.04 mg/l on the northeast side of the bay between Eleven Mile Creek and Bayou Marcus. Concentrations varied widely between 0.01 mg/l and 0.068 mg/l in the remainder of the bay such that no general distribution pattern could be derived. St. Regis is the single major contributor of elemental nitrogen to the bay and the six sewage treatment plants discharging to Bayou Marcus (primarily the Montclair and Mayfair plants) exert the greatest influence over the ammonia concentrations in Perdido Bay.

With the exception of two locations, the mouth of the Perdido River (0.01 mg/l) and the mouth of Bayou Marcus (0.03 mg/l) concentrations

FIGURE 6

ALABAMA
FLORIDA
Blackwater R
Perdido
River
Eleven Mile Cr
Bayou Marcus
Millview
Grassy Pt
Lillian
U.S Hwy 98 Bridge
Chagrin Pt
Cummings Pt
Double Pt
Bridge Cr
Nix Pt
Suarez Pt.
Du Pont Pt
Bayou Tarkiln
Tarkiln Bay
0 MILES 1
SCALE
SOUTHEAST WATER LABORATORY
ATHENS GEORGIA
TOTAL ORGANIC CARBON (mg/l)
PERDIDO BAY
9/8-19/69
U S DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
SOUTHEAST REGION ATLANTA, GEORGIA

FIGURE 7

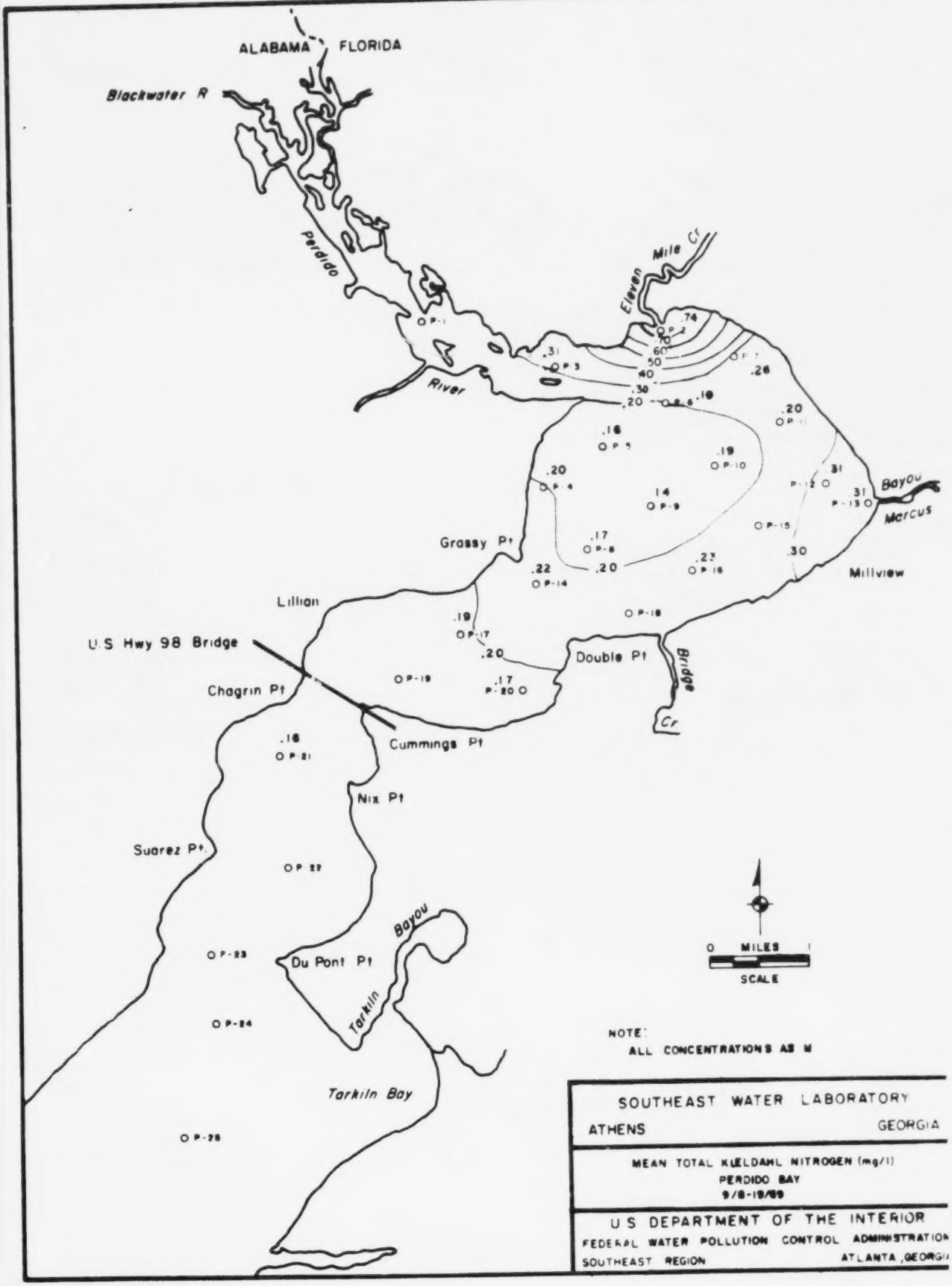

ALABAMA
FLORIDA
Blackwater R
Perdido
River
Eleven Mile Cr
Bayou Marcus
Millview
Grassy Pt
Lillian
U.S Hwy 98 Bridge
Chagrin Pt
Cummings Pt
Double Pt
Bridge Cr
Nix Pt
Suarez Pt
Du Pont Pt
Bayou Tarkiln
Tarkiln Bay
.74
.70
.60
.50
.40
.30
.20
.31
.28
.18
.16
.19
.14
.17
.22
.23
.30
.31
.17
0 MILES 1
SCALE
NOTE:
ALL CONCENTRATIONS AS N
SOUTHEAST WATER LABORATORY
ATHENS GEORGIA
MEAN TOTAL KJELDAHL NITROGEN (mg/l)
PERDIDO BAY
9/8-19/69
U S DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
SOUTHEAST REGION ATLANTA, GEORGIA

TABLE 4

MEAN NITROGEN CONCENTRATIONS

PERDIDO BAY

9/8-19/69

Location	Total Kjeldahl Nitrogen as N (mg/l)	Ammonia Nitrogen as N (mg/l)	Nitrite-Nitrate Nitrogen as N (mg/l)
P-2*	0.74	0.038	< 0.005
P-3**	0.16	0.040	0.011
P-5	0.16	0.033	<0.005
P-6	0.19	0.016	<0.005
P-7	0.26	0.030	<0.005
P-9	0.14	0.020	<0.005
P-10	0.19	0.030	<0.005
P-11	0.20	0.047	<0.005
P-12	0.31	0.027	<0.005
P-13***	0.31	0.042	0.030
P-16	0.23	0.068	<0.005
P-17	0.19	0.053	<0.005
P-21	0.16	0.025	<0.005

*mouth of Eleven Mile Creek

**mouth of Perdido River

***mouth of Bayou Marcus

of nitrite-nitrate nitrogen were all less than 0.005 mg/l, the minimum detectable limit.

Table 4 lists the nitrogenous concentrations in Perdido Bay.

6) Phosphorus

The highest concentrations of total and ortho phosphate are in the vicinity of Bayou Marcus and Eleven Mile Creek reflecting the waste effluents (Figures 8 and 9). The major inputs of total and ortho phosphate to Perdido Bay are the effluents to Bayou Marcus, principally the Montclair, Avondale, and Mayfair plants. These three sources discharged a total of 103 and 100 pounds per day of total and ortho phosphates respectively. Nearly all of the phosphates are in the ortho form, which is most readily assimilable by algae and bacteria. Of the 87 pounds per day of total phosphates discharged by St. Regis, about 38 pounds per day are in the ortho form.

The maximum concentration of total phosphate of 0.19 mg/l was observed in the mouth of Bayou Marcus. The highest concentration of ortho phosphate was in the mouth of Eleven Mile Creek amounting to 0.051 mg/l. When all other conditions are suitable, algae blooms have been observed when phosphate concentrations exceed 0.01 mg/l. The northeast portion of Perdido Bay exhibits phosphate concentrations which could be conducive to excessive algae production and resultant accelerated eutrophication.

Table 5 lists the concentrations of total and ortho phosphate in Perdido Bay.

FIGURE 8

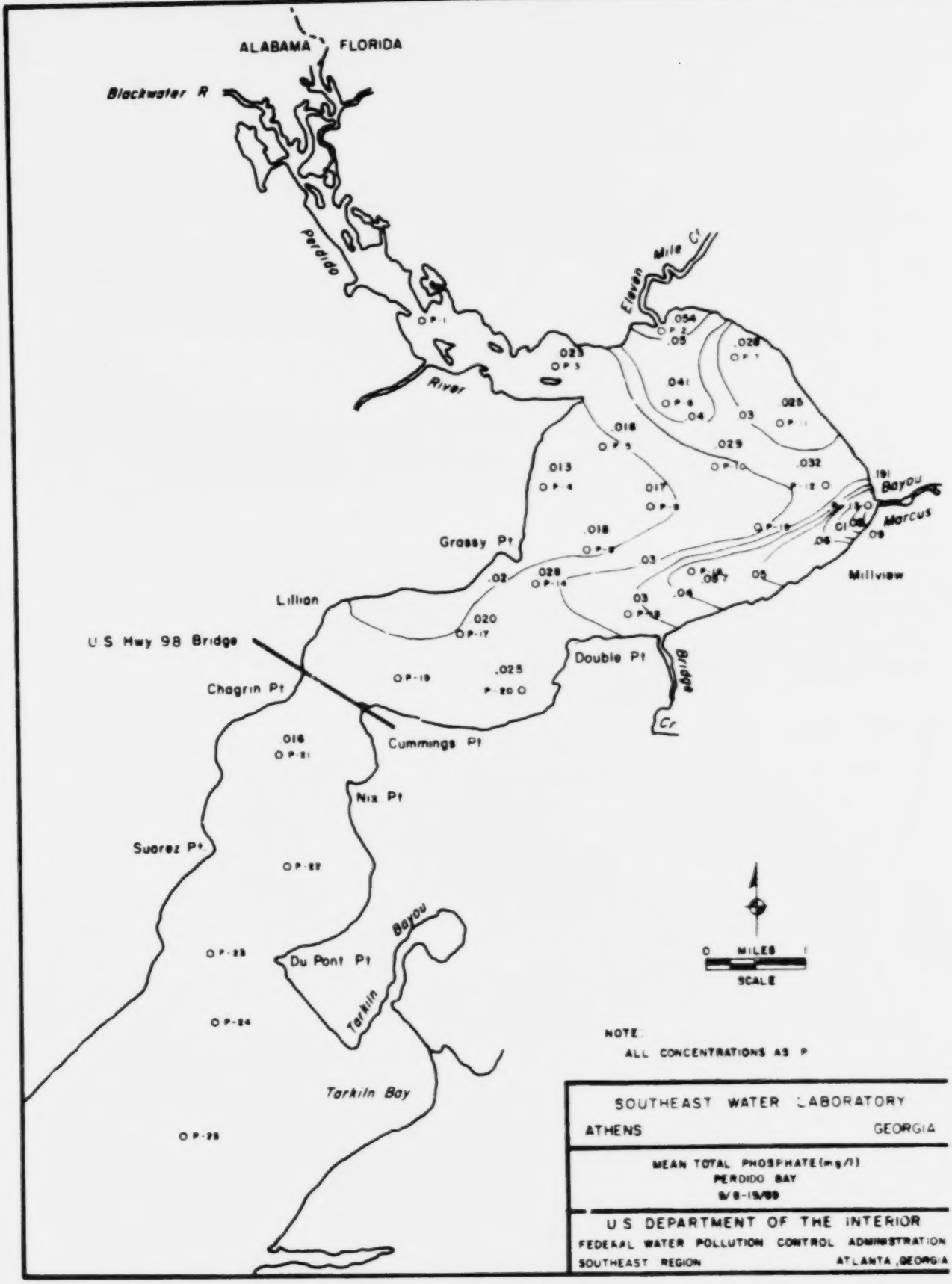

ALABAMA
FLORIDA
Blackwater R
Perdido
River
Eleven Mile Cr
Bayou
Marcus
Millview
Grassy Pt
Lillion
U S Hwy 98 Bridge
Chagrin Pt
Double Pt
Bridge
Cr
Cummings Pt
Nix Pt
Suarez Pt
Du Pont Pt
Bayou
Tarkiln
Tarkiln Bay
0 MILES 1
SCALE
NOTE
ALL CONCENTRATIONS AS P
SOUTHEAST WATER LABORATORY
ATHENS GEORGIA
MEAN TOTAL PHOSPHATE (mg/l)
PERDIDO BAY
8/8-15/69
U S DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
SOUTHEAST REGION ATLANTA, GEORGIA

FIGURE 9

ALABAMA
FLORIDA
Blackwater R
Perdido
River
Eleven Mile Cr
Bayou Marcus
Millview
Grassy Pt
Lillian
U S Hwy 98 Bridge
Chagrin Pt
Cummings Pt
Double Pt
Bridge Cr
Nix Pt
Suarez Pt
Du Pont Pt
Bayou Tarkiln
Tarkiln Bay
.05 .04 .03 .02 .01
.009
.006
.008
.005
.010
.007
.018
.007
.008
.006
.008
0 MILES 1
SCALE
NOTE:
ALL CONCENTRATIONS AS P
SOUTHEAST WATER LABORATORY
ATHENS GEORGIA
MEAN ORTHO PHOSPHATE (mg/l)
PERDIDO BAY
9/8-15/66
U S DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
SOUTHEAST REGION ATLANTA, GEORGIA

TABLE 5

MEAN PHOSPHATE CONCENTRATIONS
PERDIDO BAY
September 8-19, 1969

LOCATION	TOTAL PHOSPHATE (AS P) mg/l	ORTHO PHOSPHATE (AS P) mg/l
P-2*	0.059	0.051
P-3**	0.023	0.009
P-5	0.016	0.005
P-6	0.041	0.006
P-7	0.028	0.008
P-9	0.017	0.008
P-10	0.029	0.010
P-11	0.025	0.008
P-12	0.032	0.007
P-13***	0.190	0.026
P-16	0.057	0.016
P-17	0.020	0.006
P-21	0.016	0.005

* Mouth of Eleven Mile Creek
** Mouth of Perdido River
*** Mouth of Bayou Marcus

7) Dissolved Oxygen

There are four factors which directly affect DO in Perdido Bay: stablization of soluble or suspended oxygen demanding materials; stabilization of bottom deposits containing high organic content; photosynthesis and respiration by algae; and reaeration. Soluble and suspended oxygen demanding materials may be characterized using theoretical oxygen demand (TOD) and bio-chemical oxygen demand (BOD) concentrations. Benthic demand may be estimated from a consideration of organic carbon content of the bottom deposits. Plankton concentrations, as well as variation in dissolved oxygen at a point with time, are indicators of photosynthetic effects. Since current velocity is extremely weak in Perdido Bay, reaeration is probably not as significant as other factors in determining DO distribution in the bay.

Mean surface dissolved oxygen concentrations ranged from 7.0 to 8.0 mg/l in most of Perdido Bay and the lower Perdido River. Only the area of the bay near the mouth of Eleven Mile Creek had surface mean DO concentrations less than 4.0 mg/l, the Alabama and Florida official criterion. The mean surface DO concentration near the mouth of Eleven Mile Creek was 0.92 mg/l. The surface DO concentrations were also depressed in the vicinity of Bayou Marcus where the mean surface concentration near the mouth was 4.4 mg/l. The DO depressions described above were caused by the stabilization of soluble or suspended oxygen demanding materials from the St. Regis Paper Company and from waste sources on Bayou Marcus. The high TOD concentrations near Eleven Mile Creek (38.3 mg/l) and near

Bayou Marcus (38.8 mg/1) substantiate the conclusion that these waste sources are directly responsible for these DO depressions (Figure 10).

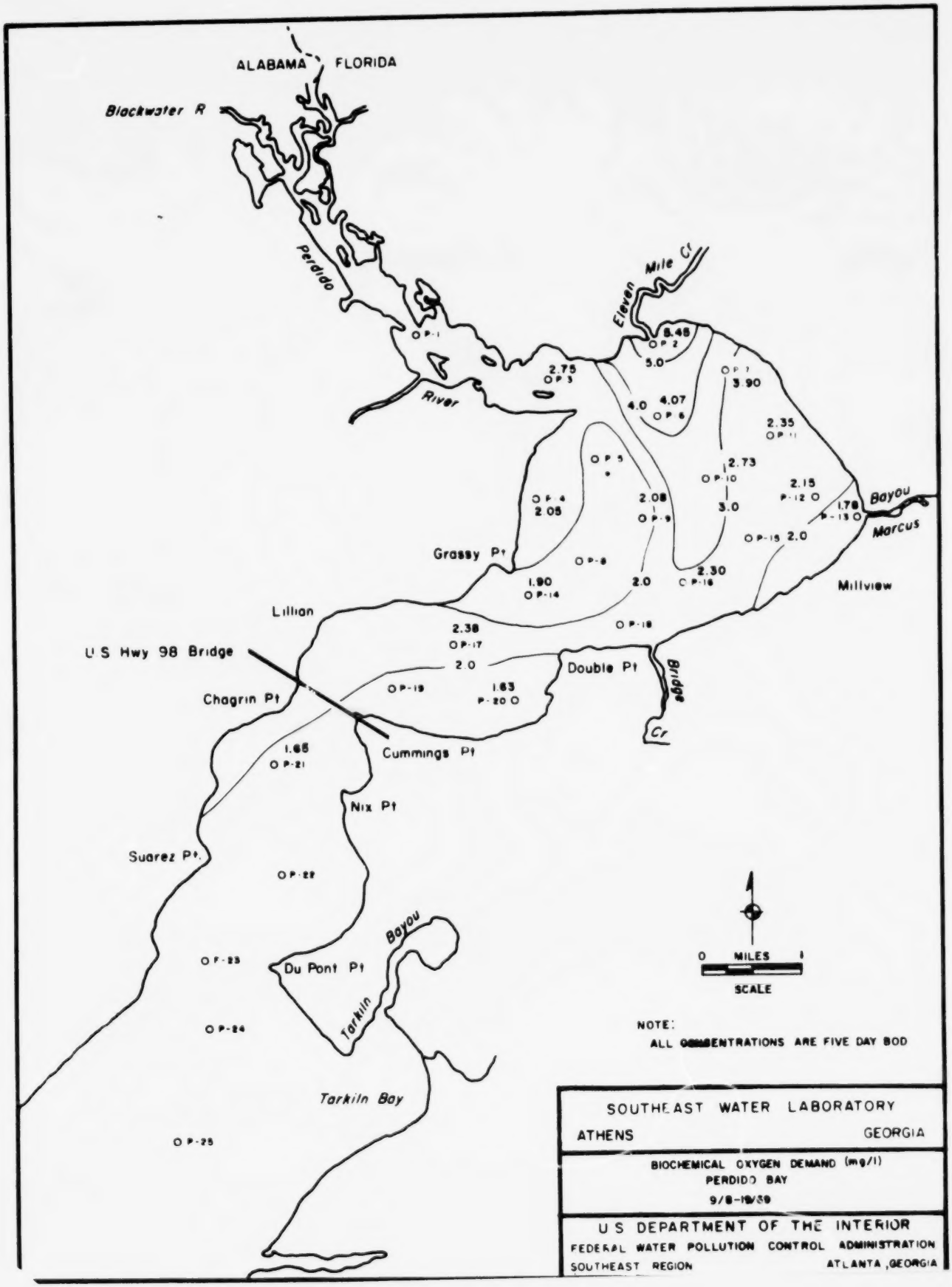
Concentrations of mean five day BOD at the mouth of Eleven Mile Creek are from two to three times higher than at any other station in the bay at a mean of 5.5 mg/1 (Figure 11). In general, the five-day BOD is above 2.5 mg/1 in most of the northern part of the bay. The major source of BOD is Eleven Mile Creek. Five-day BOD in the mouth of the Perdido River at 2.8 mg/1 is nearly five times greater than that measured above the tidal influence at U.S. 90 (0.6 mg/1). This concentration could only be caused by wastes present in the bay, principally from the St. Regis Paper Company. Five-day BOD in the mouth of Bayou Marcus was the lowest measured at any station in the upper bay at 1.8 mg/1. Both the TOD and BOD distributions show that the major source of oxygen demanding waste in Perdido Bay is Eleven Mile Creek, which primarily consists of inadequately treated waste from the St. Regis Paper Company.

Plankton samples were collected on September 26, 1969, from the surface of Perdido Bay (Figure 12). Concentrations of plankton in the surface waters of upper Perdido Bay, north of Double Point generally ranged from 2,000 to 4,000 cells per ml. The lowest concentrations occurred in a band extending from Eleven Mile Creek southeast to the Florida shore. The lowest concentration in the bay (1,395 cells per ml) was observed at the mouth of Eleven Mile Creek. Between Double Point and the U.S. 98 bridge concentrations greater than 4,000 cells per ml were observed and south of the bridge

FIGURE 10

ALABAMA
FLORIDA
Blackwater R
Perdido
River
Eleven Mile Cr
Bayou Marcus
Millview
Grassy Pt
Lillian
U.S. Hwy 98 Bridge
Chagrin Pt
Cummings Pt
Double Pt
Bridge Cr
Nix Pt
Suarez Pt.
Du Pont Pt
Bayou Tarkiln
Tarkiln Bay
0 MILES 1
SCALE
SOUTHEAST WATER LABORATORY
ATHENS GEORGIA
THEORETICAL OXYGEN DEMAND (mg/l)
PERDIDO BAY
9/8-19/69
U S DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
SOUTHEAST REGION ATLANTA, GEORGIA

FIGURE 11

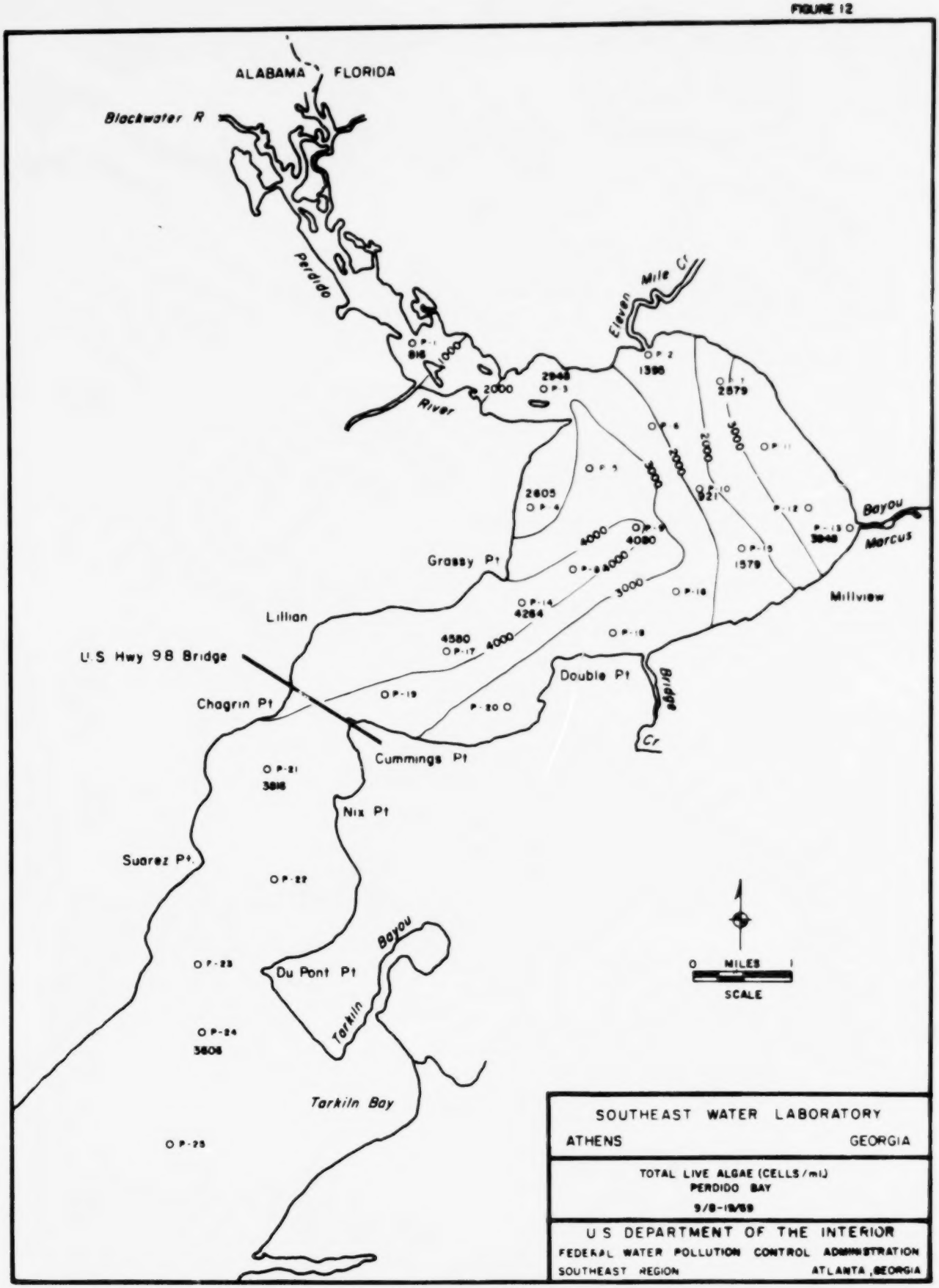


SOUTHEAST WATER LABORATORY
ATHENS GEORGIA

BIOCHEMICAL OXYGEN DEMAND (mg/l)
PERDIDO BAY
9/8-19/69

U S DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
SOUTHEAST REGION ATLANTA, GEORGIA

FIGURE 12



SOUTHEAST WATER LABORATORY
ATHENS GEORGIA

TOTAL LIVE ALGAE (CELLS/ml)
PERDIDO BAY
9/8-19/69

U S DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
SOUTHEAST REGION ATLANTA, GEORGIA

concentrations were slightly less than 4,000 cells per ml. Most of the algae grow in Perdido Bay, since concentrations in the bay were two to five times as great as those in the river.

The mean D.O. distribution at one foot from the bottom varied considerably more than did the surface concentrations (Figure 13). Thirty-six percent of the bay north of Double Point had mean D.O. concentrations of less than 4.0 mg/l. The entire eastern portion of the upper bay had mean D.O. concentrations less than 4.0 mg/l. This region has extremely poor circulation, allowing both soluble and benthic TOD to significantly reduce D.O. An extremely low mean D.O. concentration (0.60 mg/l) was observed at the mouth of Eleven Mile Creek. The lower Perdido River also had mean D.O. concentrations below 4.0 mg/l and a tongue of low D.O. protruded on the bottom from Perdido Bay into the river. These low mean D.O. concentrations in the lower Perdido River and Perdido Bay are due directly to waste from the St. Regis Paper Company discharged to Perdido Bay via Eleven Mile Creek; and to excessive demand from benthic sludge deposits resulting from this waste. The embayment between Double and Cummings Points also exhibited mean D.O. concentration less than 4.0 mg/l.

The section of the bay on the Alabama side between Grassy Point and Lillian, Alabama, had the highest bottom D.O. observed in the bay. This region coincides with the area where the highest algal concentrations were observed.

The oxygen demand of benthic deposits is the major factor affecting D.O. in the bottom water of Perdido Bay. If bottom material

FIGURE 13

ALABAMA
FLORIDA
Blackwater R
Perdido
River
Eleven Mile Cr
Bayou Marcus
Millview
Grassy Pt
Lillian
U.S. Hwy 98 Bridge
Chagrin Pt
Cummings Pt
Double Pt
Bridge
Cr
Nix Pt
Suarez Pt
Du Pont Pt
Bayou Tarkiln
Tarkiln Bay
0 MILES 1
SCALE
SOUTHEAST WATER LABORATORY
ATHENS GEORGIA
MEAN DISSOLVED OXYGEN DISTRIBUTION
(mg/l)
BOTTOM - PERDIDO BAY
U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
SOUTHEAST REGION ATLANTA, GEORGIA

contains greater than 3.0% organic carbon, then a high oxygen demand is likely to be exerted on the overlying water, and the deposit can be characterized as a sludge deposit (1). Most of the bottom of Perdido Bay north of Nix Point and the lower reach of the Perdido River have bottom sediments which contain more than 3.0% organic carbon. This blanket of oxygen demanding material amounted to more than 86% of the surface area of this portion of the lower river and bay (Figure 14).

A highly concentrated sludge deposit occurs in the Perdido River at Station P-1. The amount of organic carbon was 6.9%. A deposit containing 7.0% organic carbon is located to the east of the mouth of Eleven Mile Creek at Station P-7. This location contained the highest concentration of benthic organic carbon found in the bay. Sludge deposits with organic carbon concentrations greater than 6.0% occur throughout the area just above and below the U.S. 98 bridge. The only section of the bay containing less than 3.0% organic carbon is the western portion of the bay from Grassy Point north to Eleven Mile Creek where there is shallow water. Current velocities in this section of the bay are high enough to prevent sedimentation. When the suspended material arrives at the deeper water below Grassy Point, sedimentation takes place as can be seen by the increase in organic carbon in the sediments. The bottom sediment data are summarized in Table 6.

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(1) Problems and Management of Water Quality in Hillsborough Bay, Florida, Southeast Region, FWPCA, December, 1969.

FIGURE 14

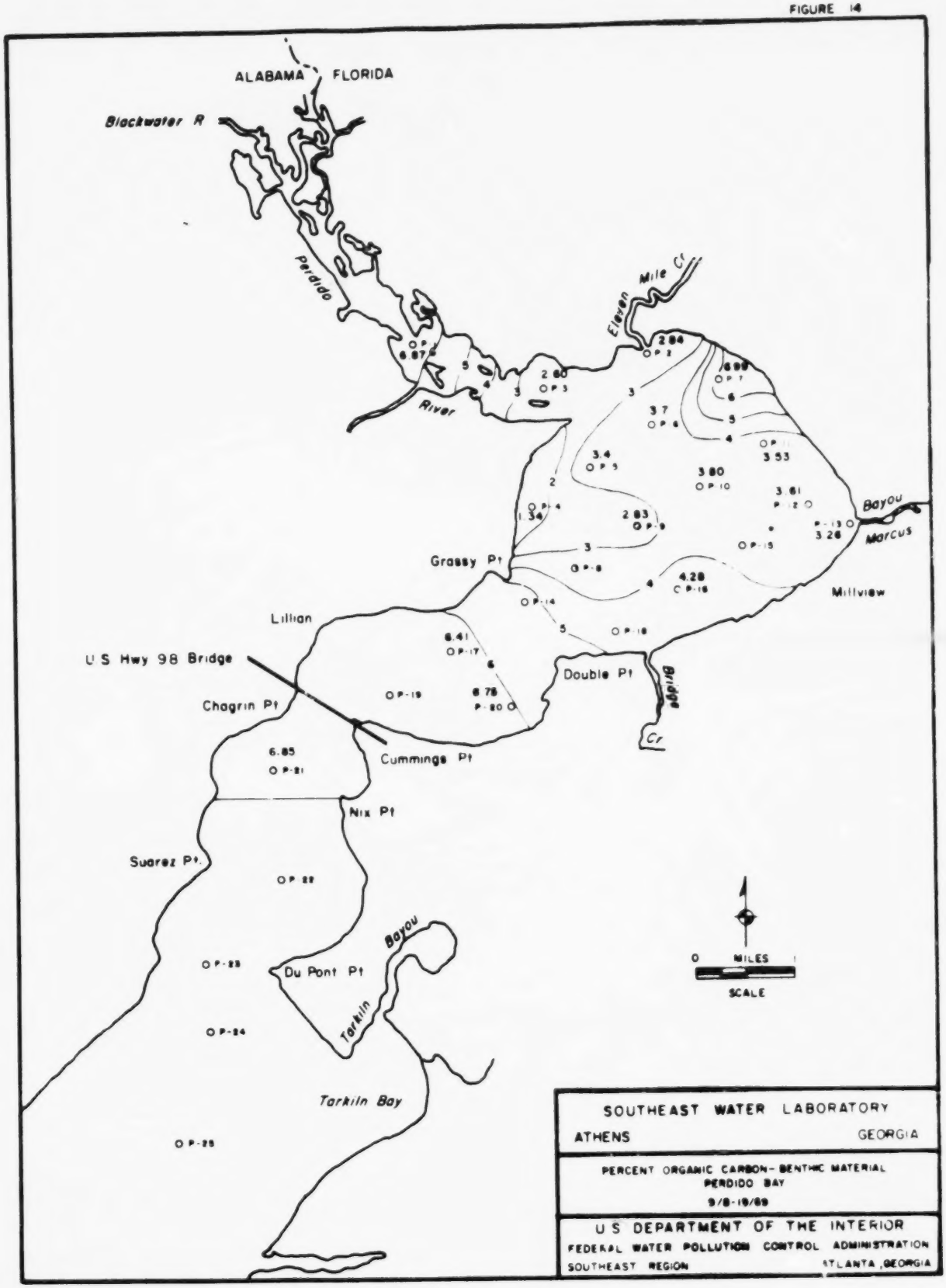
ALABAMA
FLORIDA
Blackwater R
Perdido
River
Eleven Mile Cr
Bayou Marcus
Millview
Grassy Pt
Lillian
U S Hwy 98 Bridge
Chagrin Pt
Cummings Pt
Double Pt
Bridge
Cr
Nix Pt
Suarez Pt
Du Pont Pt
Bayou Tarkiln
Tarkiln Bay
0 MILES 1
SCALE
SOUTHEAST WATER LABORATORY
ATHENS GEORGIA
PERCENT ORGANIC CARBON - BENTHIC MATERIAL
PERDIDO BAY
9/8-10/69
U S DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
SOUTHEAST REGION ATLANTA, GEORGIA

TABLE 6

SUMMARY OF BENTHIC DATA

September 13, 1969

STATION	% MOISTURE	% TOTAL VOLATILE SOLIDS	ORGANIC CARBON mg/gm	TKN mg/g	TOTAL PHOSPHORUS mg/g	RATIOS OF CARBON TO NITROGEN	TOD
P-1	79.4	14.1	68.7	2.37	0.31	29.0	194
P-2	50.9	6.3	28.4	0.64	0.11	44.4	79
P-3	51.7	4.7	27.6	0.83	0.08	33.3	77
P-4	32.6	2.4	13.4	0.53	0.07	25.3	38
P-5	52.3	4.3	34.0	1.00	0.12	34.0	95
P-6	48.9	6.0	37.0	0.76	0.10	48.7	102
P-7	71.4	13.9	69.9	3.11	0.24	22.5	201
P-9	43.9	5.3	28.3	0.80	0.11	35.4	79
P-10	58.1	8.7	38.0	0.85	0.10	44.7	105
P-11	52.6	6.7	35.3	0.82	0.09	43.0	98
P-12	48.9	5.7	36.1	0.86	0.10	42.0	100
P-13	24.5	2.2	32.6	0.19	0.07	171.6	88

Continued on next page

TABLE 6
Cont'd.

SUMMARY OF BENTHIC DATA

September 13, 1969

STATION	% MOISTURE	% TOTAL VOLATILE SOLIDS	ORGANIC CARBON mg/gm	TKN mg/g	TOTAL PHOSPHORUS mg/g	RATIOS OF CARBON TO NITROGEN	TOD
P-14	66.9	11.6	52.7	1.67	0.17	31.6	148
P-16	58.0	8.3	42.8	1.38	0.13	31.0	121
P-17	71.9	10.7	64.1	3.12	0.23	20.5	185
P-20	67.9	11.9	67.5	2.52	0.18	26.8	192
P-21	75.1	6.5	68.5	3.19	0.21	21.5	197

The ratio of organic carbon to organic nitrogen in benthic deposits is an indicator of the origin of the sediments. An investigation of benthic deposits in Charleston Harbor concluded that an organic carbon to organic nitrogen ratio above 15 indicated organic sediments resulting from industrial processes. The industry in the Charleston Harbor study was a Kraft pulp and paper mill(2). All of the benthic sediment samples collected in the lower Perdido River and in the portion of Perdido Bay north of Nix Point exhibited C:N ratios greatly in excess of 15 (Figure 15). Values in the lower Perdido River were 29 and 33.3, indicating that benthic deposits at this location are primarily caused by waste from the St. Regis Paper Company. A band with C:N ratios above 40 extends from the mouth of Eleven Mile Creek to Bayou Marcus. Near the eastern shore, between Eleven Mile Creek and Bayou Marcus, the C:N ratio was 22.5. TheC:N ratio decreases from Eleven Mile Creek to the U.S. 98 bridge. The lowest ratio was significantly above 15, indicating that the paper mill waste is the major cause of sludge deposits throughout the bay.

In summary, wastes discharged to Perdido Bay from both Eleven Mile Creek and Bayou Marcus disperse into the mouth of the Perdido River and the northeastern portion of Perdido Bay. The D.O. at the bottom of a significant portion of the upper bay is below 4.0 mg/l,

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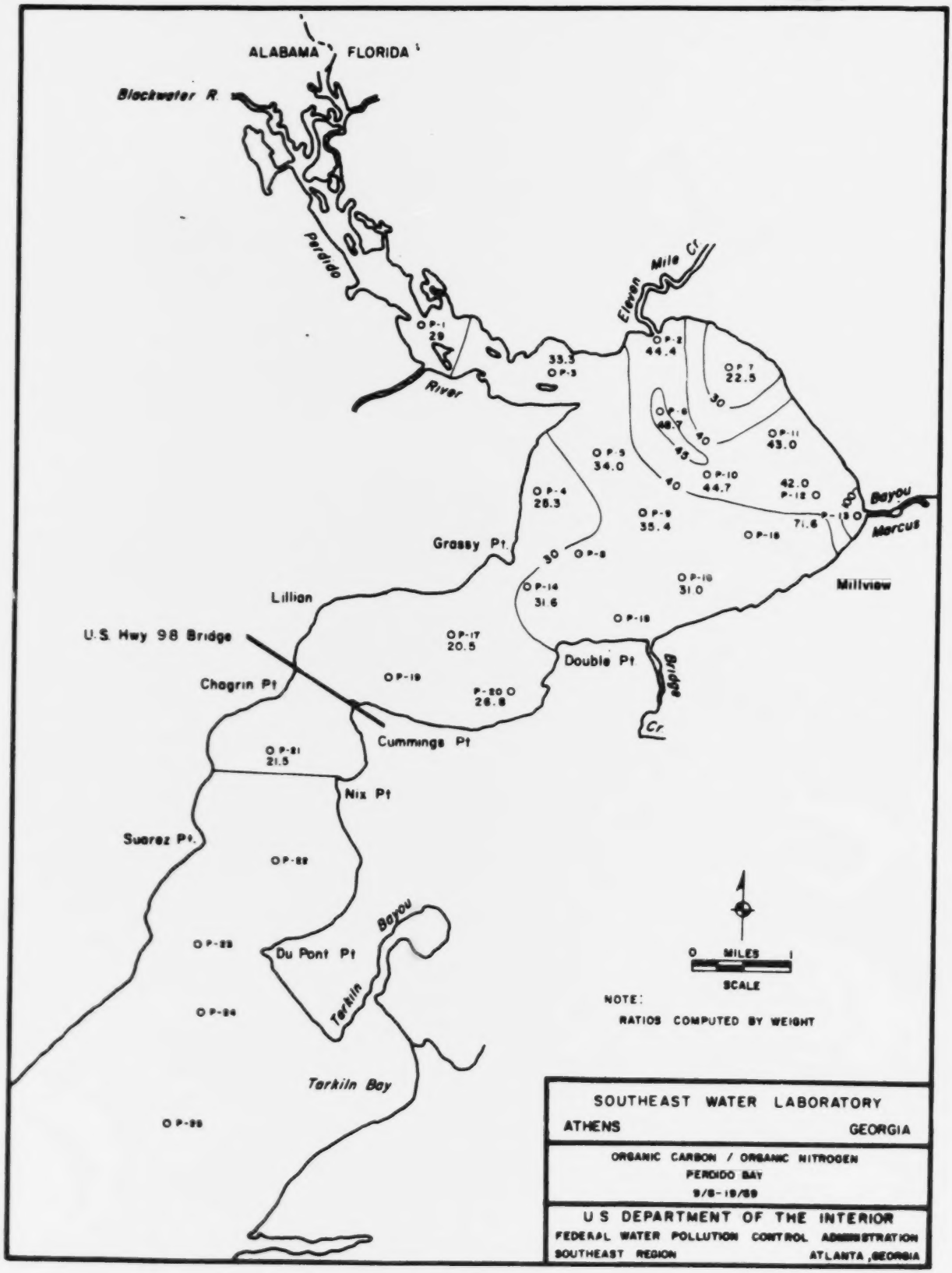
(2) Finger, J. H. and Wastler, T. A., "Organic Carbon-Organic Nitrogen Ratios of Sediments in a Polluted Estuary", Research Supplement Journal of the Water Pollution Control Federation, February, 1969.

FIGURE 15


ALABAMA
FLORIDA
Blackwater R.
Perdido
River
Eleven Mile Cr
Bayou Marcus
Millview
Grassy Pt.
Lillian
U.S. Hwy 98 Bridge
Chagrin Pt
Cummings Pt
Nix Pt
Suarez Pt.
Double Pt
Bridge
Cr
Bayou
Du Pont Pt
Tarkiln
Tarkiln Bay
OP-1 29
OP-2 44.4
33.5 OP-3
OP-4 28.3
OP-5 34.0
OP-6 44.7
OP 7 22.5
OP-8
OP-9 35.4
OP-10 44.7
OP-11 43.0
42.0 P-12
P-13
71.6
OP-14 31.6
OP-15
OP-16 31.0
OP-17 20.5
OP-18
OP-19
P-20 28.8
OP-21 21.5
OP-22
OP-23
OP-24
OP-25
30
40
45
50
0 MILES 1
SCALE
NOTE:
RATIOS COMPUTED BY WEIGHT
SOUTHEAST WATER LABORATORY
ATHENS GEORGIA
ORGANIC CARBON / ORGANIC NITROGEN
PERDIDO BAY
9/8-19/69
U S DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
SOUTHEAST REGION ATLANTA, GEORGIA

the official criterion of the states of Florida and Alabama. The major source of the low dissolved oxygen is the effluent of the St. Regis Paper Company from Eleven Mile Creek and benthic sludge deposits resulting from the St. Regis effluent.

VII. ABATEMENT

To restore water quality in Perdido Bay to levels which will permit a wide diversity of desirable uses for both Alabama and Florida residents, a waste abatement program specifying very high degrees of carbonaceous waste removal and changes in industrial processes, as well as consolidation of smaller waste inputs is required.

Carbon is the single most significant constituent in causing adverse water quality conditions in Perdido Bay. Carbon is present in the bay from artificial sources, upstream runoff and atmospheric diffusion of carbon dioxide. Excessive carbon can result in accelerated eutrophication if limiting concentrations of other necessary nutrients are exceeded. At the present time, however, the levels of nitrate in the bay are sufficiently low to prevent accelerated eutrophication although phosphate in parts of the bay exceeds values observed when algae blooms have occurred in other waters.(3) Future development in and around the bay and its tributary streams could contribute nitrogenous materials to the point where accelerated eutrophication could occur. To prevent such overstimulation of biological activity, high removal of carbonaceous materials is required.

The untreated waste effluent from the St. Regis Paper Company is overwhelmingly the most significant source of carbon in the bay.

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(3) Bacteria, Carbon Dioxide and Algal Blooms; Kuentzel, L.E.; Journal of Water Pollution Control Federation, October, 1969, p. 1737-1747.

The average organic carbon content of Perdido Bay is 7 mg/l which is about 27 times greater than the natural levels of carbon from atmospheric diffusion. As a first step in reducing the high carbon levels of the bay and abating the existing pollution, St. Regis Paper Company should reduce its carbon contribution by 90%. Allowing for the present 38% reduction in the holding ponds, the St. Regis waste effluent, as measured below the riffle terraces, should not exceed 8,880 pounds per day of five-day BOD or 2,610 pounds per day of total organic carbon (TOC).

St. Regis Paper Company should remove the foam causing constituents from its waste effluent.

St. Regis Paper Company should reduce the color of its waste discharge to levels not greater than background measured at the U. S. 90 bridge on the Perdido and Styx Rivers.

Even with the high levels of waste removal specified for the St. Regis Paper Company, Eleven Mile Creek will probably not meet the criteria set by the State of Florida for industrial use. St. Regis Paper Company should make a feasibility study by January 1, 1971, of complete recirculation, treatment, and reuse of its process water in an essentially closed system.

The six sewage treatment plants on Bayou Marcus should be consolidated into a central facility and the removal efficiency should be increased to 90% of carbonaceous material.

APPENDIXES

APPENDIX I

PROJECT PERSONNEL

Federal Water Pollution Control Administration (Southeast Water Laboratory)

Paul L. Wagner	Sanitary Engineer
Lawrence W. Olinger	Sanitary Engineer
Thomas P. Gallagher	Sanitary Engineer
Roy A. Whatley	Hydrologist
Dennis T. Cafaro	Sanitary Engineer
R. Wade Knight	Chemist
Ray N. Hemphill	Chemist
Lavon H. Revells	Chemist
Thomas B. Bennett, Jr.	Chemist
William E. Loy	Chemist
Ralph E. Gentry	Microbiologist
Jerry L. Dause	Sanitary Engineer
Raymond T. Wilkerson	Technician
Roy A. Wiemert	Technician
Ronald R. Sexton	Technician
Michael Swinford	Technician
Hoke Howard	Technician

University of West Florida Graduate Students

Nick Whiting	Thomas Heitmuller	Dona Jarvis
Stephen Howard	Andrew Auld	Rod Presnell

The following people materially contributed to this study through use of facilities and equipment as well as supplying invaluable background data and material necessary to successful completion of this project.

Dr. Thomas Hopkins	University of West Florida
Mr. Wayne Tisdale	Florida Department of Health
Mr. Gordon Richmond	Florida Department of Health
Mr. Frank Skipper	Florida Department of Air and Water Pollution Control
Mr. William Young	Florida Department of Air and Water Pollution Control
Mr. Ted Ripsburger	Florida Department of Air and Water Pollution Control
Mr. John Williford	Alabama Water Improvement Commission

APPENDIX II

SAMPLING PROCEDURE AND METHODOLOGY

A. Sampling Procedure

The Perdido Bay field study commenced on September 9 and continued for a period of nine days until September 17, 1969. The sampling runs were conducted as follows:

Run No.	Date September 1969	Sampling Period
1	9	1:00 - 3:00 PM
2	10	9:00 - 11:00 AM
3	10	1:30 - 3:30 PM
4	11	9:00 - 11:00 AM
5	11	2:00 - 4:00 PM
6	12	10:00 AM - 2:00 PM
7	13	10:30 AM - 2:00 PM
8	15	10:00 AM - 2:30 PM
9	16	11:00 AM - 2:00 PM
10	17	10:30 AM - 2:30 PM

Samples were collected at 25 pre-established bouy marker locations. The bouys were placed into position utilizing two standard surveying transits and employing triangulation techniques. Bouys P-2, P-3 and P-13 were placed in the mouths of Eleven Mile Creek, the Perdido River and Bayou Marcus respectively. Boup P-1 was located in the mid-channel of the Perdido River approximately one mile north of the mouth. Bouys P-4 through P-19 (except P-13) were located on a regular 3/4 mile grid pattern covering all of Perdido Bay north of the U. S. 98 bridge. The

grid pattern was established using bouys P-11, 19, 9, 8, 14, 17 and 19 as the base line, on a line of sight between Ramsey Beach and the eastern end of the U. S. 98 bridge. Bouys P-21-25 were located along the centerline of lower Perdido Bay at one mile intervals below the bridge.

During sampling runs 1-5, samples were collected at the mid-depth level only, while on runs 6-10 samples were collected one foot below the surface, one foot above the bottom and the mid-depth. Stations located in water less than five feet were sampled at less than these three depths. In addition to DO, temperature, pH and chloride concentration, which were measured on every sample collected, nitrogen series, TOC and phosphorus series were measured at sixteen special stations, alternating eight each day. Special samples sets for lignin-like compounds, floating plankton, benthic muds and resin acids were taken on a one time basis at selected stations.

B. Analytical Methodology

1. Total Kjeldahl Nitrogen - (Automated Phenolate Method)

TKN is defined as the sum of free ammonia and organic nitrogen compounds which are converted to ammonia sulfate under the specified digestion conditions. The samples are automatically digested with a sulfuric acid solution containing potassium sulfate and mercuric sulfate as a catalyst to convert organic nitrogen to ammonium sulfate. The solution is then automatically neutralized with a sodium hydroxide solution and treated with alkaline phenol

reagent and sodium hypochlorite reagent. This addition forms a blue color designated as idophenol. Sodium nitroprusside, which increases the intensity of the color, is added to obtain necessary sensitivity for measurement of low level nitrogen. The reaction color is measured at a wavelength of 630 mu. The TKN of the samples is compared against standards of urea carried through the entire procedure.

The bottom samples were digested by the manual method (12th Edition, Standard Methods) followed by pH adjustment and nitrogen analysis by the method below (2). The automated procedure for TKN is the SEWL standard method and appears in FWPCA Methods for Chemical Analysis of Water and Wastes, November 1969.

2. Ammonia Nitrogen (Automated Method, FWPCA Method for Chemical Analysis of Water and Wastes, November, 1969).

Ammonia nitrogen is analyzed for by its reaction with alkaline phenol hypochlorite. The intensity of the indophenol blue color which is formed is measured at 630 mu. Ammonium sulfate standards are used for calibration.

3. Total Nitrate-Nitrite Nitrogen (Automated Cadmium Reduction Method, FWPCA Methods for Chemical Analysis of Water and Wastes, November 1969).

This method is used to determine nitrates and nitrites singly or combined. The initial step of the procedure is to reduce nitrates to nitrites by using a cadmium-copper reduction column. The nitrites are then diazotized and coupled to form the azo dye. The dye intensity of both samples and standards is then measured at a wavelength of 540 mu.

4. Phosphorus (Automated Ascorbic Acid Method, FWPCA Methods for Chemical Analysis of Water and Wastes, November, 1969).

Phosphorus is reacted with ammonium molybdate and potassium antimonyl tartrate to form an antimony-phosphate-molybdate complex. This complex is reduced to an intensely blue colored complex by ascorbic acid. The color is proportional to the phosphorus concentration. The total phosphorus analysis on the water and bottom samples was carried out by this procedure preceeded by acid persulfate digestion.

5 Total Organic Carbon (FWPCA Methods for Chemical Analysis of Water and Wastes, November, 1969).

A micro sample of water is injected into a catalytic combustion tube heated to 950°C. The carbonaceous material is oxidized to carbon dioxide. An oxygen stream carries the CO_2 to an infrared analyzer sensitized to provide a measure of CO_2. The amount of CO_2 present is directly proportional to the concentration of carbonaceous material in the injected sample. The instrument used for this analysis is the Beckman Carbonaceous Analyzer, Model No. 915, dual channel.

6. Chemical Oxygen Demand (FWPCA Methods for Chemical Analysis of Water and Wastes, November, 1969).

Organic materials in water samples are oxidized by potassium dichromate solution in 50 percent sulfuric acid. The excess dichromate is titrated with standard ferrous ammonium sulfate using ferroin as an indicator. The amount of dichromate used in the oxidation is proportional to the amount of organic and oxidizable inorganic matter in the sample. This procedure was used for analyzing both water and

mud samples.

7. Chlorides (Automated Ferricyanide Method, FWPCA Methods for Chemical Analysis of Water and Wastes, November, 1969).

Thiocyanate ion is liberated from mercuric thiocyanate through sequestration of mercury by chloride ion to form unionized mercuric chloride. In the presence of ferric ion, the liberated thiocyanate forms highly colored ferric thiocyanate, in concentration proportional to the original chloride concentration.

8. Biochemical Oxygen Demand, Lignin-like Compounds and Color.

These analyses were all carried out by the procedures outlined in Standard Methods for the Examination of Water and Waste Water, 12th Edition, 1965. The lignin and color analyses were performed approximately six weeks after collection.

9. Resin Acids

The samples were acidified and extracted with chloroform. The sample extracts were dried and esterified using the diazomethane procedure of Schlenk and Gellerman. The esterified extracts were adjusted to a certain volume and analyzed using a gas chromatograph equipped with dual flame ionization detectors. The identity of the resin acids was substantiated using mass spectrometry.

APPENDIX III

WASTE SOURCE AND WATER QUALITY DATA

PERDIDO BAY

September 9 - 17, 1969

Date	Flow (mgd)	Temperature (°C)	BOD 2-day (mg/l)	BOD 5-day (mg/l)	pH	Nitrogen Series Kjeldahl (mg/l)	Nitrogen Series NH_3 (mg/l)	Nitrogen Series NO_2 -NO_3 (mg/l)	Phosphorus Series Total P (mg/l)	Phosphorus Series Ortho P (mg/l)	DO (mg/l)	TOC (mg/l)
				St. Regis Paper Company								
				Effluent Before Ponds (A-2a)								
9/11	26.9	40	342.0	522.0	10.6							
9/12	26.9	41	360.0	511.0	10.2							
9/13	26.9	40	86.5	160.0	9.1							
				Effluent Below Riffle Terraces (A-2b)								
9/11	26.9	30	75.0	146.0	9.2							
9/12	26.9	30	120.0	371.0	8.1							
9/13	26.9	30	111.0	222.0	7.9							
				Elevenmile Creek - Rt. 297 Bridge (A-7)								
9/9		31	--	111.0	--						0.5	
9/11		29	85.0	151.0	7.7						0.6	
9/13		29	141.0	232.0	7.6						0.0	
9/15		--	79.9	133.5	7.6						0.0	
9/16		30	86.0	124.8	7.9						0.0	
9/18		27	96.0	154.3	7.8	1.84	0.050	0.006	0.390	0.171	0.0	72
				Elevenmile Creek - Rt. 90 Bridge (A-8)								
9/9		30	--	63.0	--						0.0	
9/11		28	--	--	7.5						0.2	
9/13		26	153.5	211.3	7.6						0.5	
9/15		--	48.2	106.0	7.4						0.0	
9/16		27	49.9	111.1	7.4						0.3	
9/18		24	71.0	118.0	7.7	1.16	0.010	0.015	0.236	0.068	0.0	35
				Perdido River - Rte. 184 Bridge (A-10)								
9/9	382	24	-	0.6	-						7.8	
9/11	350	21	0.0	0.6	6.8						8.2	
				Perdido River - Rte. 90 Bridge (A-9)								
9/9	382	25	-	1.1	-						6.3	
9/11	350	23	0.6	0.6	6.3						7.8	
9/11	350	23	0.2	0.1	6.4						7.2	

APPENDIX III

WASTE SOURCE AND WATER QUALITY DATA

PERDIDO BAY

September 9-17, 1969

Date	Flow (mgd)	Temperature (°C)	BOD 2-day (mg/l)	BOD 5-day (mg/l)	pH	Nitrogen Series Kjeldahl (mg/l)	Nitrogen Series NH_3 (mg/l)	Nitrogen Series NO_2-NO_3 (mg/l)	Phosphorus Series Total P (mg/l)	Phosphorus Series Ortho P (mg/l)	DO (mg/l)	TOC (mg/l)
9/13	324	21	-	-	-						8.0	
9/15	312	-	0.3	0.5	6.5						7.2	
					Fairway Mobile Home Court							
9/18	0.004*	-	0.7	0.9	-	4.20	13.20	0.056	6.02	6.50	-	13
					West Pensacola Utilities STP (Avondale)							
9/18	0.175*	-	7.6	17.6	-	13.90	13.0	0.020	14.8	14.0	-	32
					Montclair STP							
9/18	0.525*	-	3.4	8.5	-	22.0	19.8	5.50	12.3	12.0	-	17
					Devenshire STP							
9/18	0.017*	-	3.5	7.1	-	20.15	16.6	20.6	20.3	20.0	-	14
					Mayfair STP							
9/18	0.175*	-	6.0	16.3	-	29.00	28.9	1.760	18.5	18.5	-	19
					Saufly Field (NAS)							
9/18	0.210*	-	9.6	30.0	-	0.14	0.10	0.570	0.034	0.033	-	1

*Flows based upon 1966 mean discharge data.

APPENDIX III
SUMMARY OF DATA
PERDIDO BAY - 9/9/69 TO 9/17/69

STATION NO. P01S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1100	01.0	27.0	06.6	082.1	01350	-	-	-	-	-	-
09/13/69	1610	-	27.0	08.0	100.2	02150	-	-	-	-	-	-
09/15/69	1350	-	27.0	07.4	091.7	01300	-	-	-	-	-	-
09/16/69	0945	-	-	-	-	11550	-	-	-	-	-	-
09/17/69	0950	-	27.0	07.7	095.6	01150	-	-	-	-	-	-

STATION NO. P01M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/09/69	1355	12.0	27.5	00.3	004.0	08550	-	-	-	-	-	-
09/10/69	1025	-	27.0	00.4	005.2	07850	-	-	-	-	-	-
09/10/69	1520	-	27.0	-	-	08900	-	-	-	-	-	-
09/11/69	1020	-	27.0	04.2	055.9	08550	-	-	-	-	-	-
09/11/69	1530	-	26.0	01.4	018.1	07500	-	-	-	-	-	-
09/12/69	1100	12.0	-	01.0	-	08250	-	-	-	-	-	-
09/13/69	1610	-	-	00.1	-	11300	-	-	-	-	-	-
09/15/69	1350	-	-	01.0	-	09350	-	-	-	-	-	-
09/16/69	0945	-	-	-	-	10700	-	-	-	-	-	-
09/17/69	0950	-	-	00.3	-	09800	-	-	-	-	-	-

STATION NO. P01B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1100	24.0	-	01.1	-	09250	-	-	-	-	-	-
09/13/69	1610	-	-	00.1	-	11650	-	-	-	-	-	-
09/15/69	1350	-	-	00.0	-	11050	-	-	-	-	-	-
09/16/69	0945	-	-	-	-	01000	-	-	-	-	-	-
09/17/69	0950	-	-	00.4	-	11600	-	-	-	-	-	-

APPENDIX III
SUMMARY OF DATA
PERDIDO BAY - 9/9/69 TO 9/17/69

STATION NO. P02S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1100	01.0	24.0	01.8	021.8	04500	-	-	-	-	-	-
09/13/69	1630	-	26.0	00.0	000.0	01250	-	-	-	-	-	-
09/15/69	1250	-	25.8	02.8	035.0	04200	-	-	-	-	-	-
09/16/69	1000	-	-	-	-	02600	-	-	-	-	-	-
09/17/69	1005	-	24.0	00.0	000.0	04400	-	-	-	-	-	-

STATION NO. P02M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/09/69	1410	03.5	29.0	00.9	011.5	02300	-	-	-	-	-	-
09/10/69	1040	-	27.0	02.2	028.1	04550	-	-	-	-	-	-
09/10/69	1540	-	27.0	01.8	023.0	04700	0.28	.02	<.005	0.028	0.006	09
09/11/69	1025	-	25.0	05.0	061.6	04100	-	-	-	-	-	-
09/11/69	1550	-	25.0	05.0	061.3	03600	-	-	-	-	-	-
09/12/69	1100	03.5	-	02.1	-	04450	-	-	-	-	-	-
09/13/69	1630	-	-	02.2	-	03850	-	-	-	-	-	-
09/15/69	1250	-	-	00.0	-	02500	0.84	.08	.005	0.082	0.097	-
09/16/69	1000	-	-	-	-	03050	-	-	-	-	-	-
09/17/69	1005	-	-	00.0	-	05200	1.10	.14	.005	0.067	0.052	18

STATION NO. P02B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1100	07.0	-	02.7	-	05100	-	-	-	-	-	-
09/13/69	1630	-	-	00.0	-	06150	-	-	-	-	-	-
09/15/69	1250	-	-	00.0	-	03400	-	-	-	-	-	-
09/16/69	1000	-	-	-	-	07250	-	-	-	-	-	-
09/17/69	1005	-	-	00.2	-	06750	-	-	-	-	-	-

APPENDIX III
SUMMARY OF DATA
PERDIDO BAY - 9/9/69 TO 9/17/69

STATION NO. P03S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1100	01.0	24.5	07.4	098.4	03650	-	-	-	-	-	-
09/13/69	1620	-	26.0	09.0	112.4	03650	-	-	-	-	-	-
09/15/69	1340	-	26.8	08.4	105.4	02750	-	-	-	-	-	-
09/16/69	0950	-	-	-	-	02100	-	-	-	-	-	-
09/17/69	1000	-	26.5	06.6	082.1	02350	-	-	-	-	-	-

STATION NO. P03M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/09/69	1345	04.0	24.0	06.9	088.5	02850	0.52	.03	<.005	0.028	0.015	05
09/10/69	1015	-	25.0	06.5	079.1	02800	-	-	-	-	-	-
09/10/69	1513	-	26.0	07.4	091.7	02800	-	-	-	-	-	-
09/11/69	1015	-	24.0	06.0	072.2	03550	-	-	-	-	-	-
09/11/69	1525	-	25.0	07.6	092.9	03200	0.20	.03	.009	0.018	0.006	-
09/12/69	1100	04.0	-	06.3	-	04050	-	-	-	-	-	-
09/13/69	1620	-	-	07.3	-	03850	0.20	.04	<.005	0.013	0.005	-
09/15/69	1340	-	-	-	-	05250	-	-	-	-	-	-
09/16/69	0950	-	-	-	-	03050	0.20	.06	.026	0.036	0.012	04
09/17/69	1000	-	-	01.4	-	06300	-	-	-	-	-	-

STATION NO. P03B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1100	08.0	-	03.5	-	06100	-	-	-	-	-	-
09/13/69	1620	-	-	08.0	-	04350	-	-	-	-	-	-
09/15/69	1340	-	-	03.1	-	08350	-	-	-	-	-	-
09/16/69	0950	-	-	-	-	08550	-	-	-	-	-	-
09/17/69	1000	-	-	00.0	-	09400	-	-	-	-	-	-

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APPENDIX III
SUMMARY OF DATA
PERDIDO BAY - 9/9/69 TO 9/17/69

STATION NO. P04S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1120	01.0	23.5	08.0	095.6	03700	-	-	-	-	-	-
09/13/69	1305	-	25.0	08.4	102.9	03500	-	-	-	-	-	-
09/15/69	1225	-	25.9	07.9	098.5	03700	-	-	-	-	-	-
09/16/69	1035	-	-	-	-	04200	-	-	-	-	-	-
09/17/69	1030	-	26.0	06.1	076.4	04000	-	-	-	-	-	-

STATION NO. P04M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/09/69	1330	03.5	29.0	07.5	098.4	03500	-	-	-	-	-	-
09/10/69	1005	-	26.0	07.6	095.0	03750	-	-	-	-	-	-
09/10/69	1455	-	27.0	04.4	-	-	0.20	<.01	<.005	0.010	<0.005	06
09/11/69	0920	-	24.0	07.6	091.7	03750	-	-	-	-	-	-
09/11/69	1550	-	25.0	07.5	093.3	03300	-	-	-	-	-	-
09/12/69	1120	04.0	-	08.2	-	03600	0.16	.03	<.005	0.014	0.009	-
09/13/69	1305	-	-	08.1	-	03500	-	-	-	-	-	-
09/15/69	1225	-	-	07.8	-	03700	-	-	-	-	-	-
09/16/69	1035	-	-	-	-	04300	-	-	-	-	-	-
09/17/69	1030	-	-	06.0	-	04600	0.25	.03	<.005	0.016	<0.005	08

STATION NO. P04B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1120	08.0	-	08.3	-	03700	-	-	-	-	-	-
09/13/69	1305	-	-	01.9	-	03800	-	-	-	-	-	-
09/15/69	1225	-	-	08.2	-	03650	-	-	-	-	-	-
09/16/69	1035	-	-	-	-	04000	-	-	-	-	-	-
09/17/69	1030	-	-	05.9	-	05250	-	-	-	-	-	-

APPENDIX III
SUMMARY OF DATA
PERDIDO BAY - 9/9/69 TO 9/17/69

STATION NO. P05S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1115	01.0	24.0	07.3	094.0	03600	-	-	-	-	-	-
09/13/69	1256	-	24.5	08.4	101.8	03300	-	-	-	-	-	-
09/15/69	1220	-	26.0	08.7	108.3	03350	-	-	-	-	-	-
09/16/69	1025	-	-	-	-	03900	-	-	-	-	-	-
09/17/69	1025	-	26.5	06.7	084.1	03250	-	-	-	-	-	-

STATION NO. P05M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/09/69	1333	04.0	28.5	07.1	092.3	03500	-	-	-	-	-	-
09/10/69	1010	-	26.0	07.3	091.1	03650	-	-	-	-	-	-
09/10/69	1505	-	26.0	06.2	078.2	04800	-	-	-	-	-	-
09/11/69	1010	-	24.0	07.9	095.3	03700	-	-	-	-	-	-
09/11/69	1500	-	25.0	07.5	093.1	03450	0.17	.03	<.005	0.015	0.006	-
09/12/69	1115	04.0	-	08.1	-	03650	-	-	-	-	-	-
09/13/69	1256	-	-	08.3	-	03450	0.11	.04	<.005	0.017	<0.005	-
09/15/69	1220	-	-	07.2	-	03400	-	-	-	-	-	-
09/16/69	1025	-	-	-	-	03850	0.19	.03	<.005	0.016	<0.005	05
09/17/69	1025	-	-	06.5	-	04500	-	-	-	-	-	-

STATION NO. P05B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1115	08.0	-	06.5	-	05250	-	-	-	-	-	-
09/13/69	1256	-	-	02.2	-	10250	-	-	-	-	-	-
09/15/69	1220	-	-	03.4	-	08300	-	-	-	-	-	-
09/16/69	1025	-	-	-	-	08750	-	-	-	-	-	-
09/17/69	1025	-	-	02.4	-	08250	-	-	-	-	-	-

APPENDIX III
SUMMARY OF DATA
PERDIDO BAY - 9/9/69 TO 9/17/69

STATION NO. P06S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1100	01.0	24.0	07.1	085.3	03300	-	-	-	-	-	-
09/16/69	1020	-	-	-	-	04350	-	-	-	-	-	-
09/17/69	1020	-	26.5	06.5	082.1	04000	-	-	-	-	-	-

STATION NO. P06M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/09/69	1403	03.5	29.5	07.3	096.6	03550	-	-	-	-	-	-
09/10/69	1045	-	26.0	07.2	089.8	03500	-	-	-	-	-	-
09/10/69	1550	-	27.0	07.3	092.2	07550	-	-	-	-	-	-
09/11/69	1030	-	24.0	08.4	101.4	03800	-	-	-	-	-	-
09/11/69	1545	-	25.0	07.8	097.4	03700	-	-	-	-	-	-
09/12/69	1100	03.5	-	06.1	-	03250	0.17	.02	<.005	0.022	0.009	-
09/13/69	1600	-	-	09.6	-	04250	-	-	-	-	-	-
09/15/69	1245	-	-	07.1	-	03850	0.11	<.01	<.005	0.084	<0.005	-
09/16/69	1020	-	-	-	-	04200	-	-	-	-	-	-
09/17/69	1020	-	-	05.2	-	06700	0.30	.02	<.005	0.019	<0.005	07

STATION NO. P06B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1100	07.0	-	05.5	-	03600	-	-	-	-	-	-
09/13/69	1600	-	-	09.1	-	04100	-	-	-	-	-	-
09/15/69	1245	-	-	06.4	-	06200	-	-	-	-	-	-
09/16/69	1020	-	-	-	-	08600	-	-	-	-	-	-
09/17/69	1020	-	-	02.8	-	09700	-	-	-	-	-	-

APPENDIX III
SUMMARY OF DATA
PERDIDO BAY - 9/9/69 TO 9/17/69

STATION NO. P07S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1010	01.0	24.0	06.9	083.2	03750	-	-	-	-	-	-
09/13/69	1645	-	26.0	09.9	124.3	04250	-	-	-	-	-	-
09/15/69	1255	-	-	-	-	05550	-	-	-	-	-	-
09/16/69	1005	-	-	-	-	05250	-	-	-	-	-	-
09/17/69	1015	-	26.5	05.8	074.4	05450	-	-	-	-	-	-

STATION NO. P07M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/09/69	1415	03.5	29.5	07.9	104.3	03300	0.47	.04	<.005	0.029	0.014	05
09/10/69	1055	-	27.0	02.0	025.7	05150	-	-	-	-	-	-
09/10/69	1600	-	27.5	02.8	036.7	06250	-	-	-	-	-	-
09/11/69	1030	-	24.0	07.5	090.4	03600	-	-	-	-	-	-
09/11/69	1555	-	26.0	08.9	111.5	04000	0.19	.03	<.005	0.024	0.010	-
09/12/69	1010	03.5	-	05.2	-	04950	-	-	-	-	-	-
09/13/69	1645	-	-	06.5	-	05400	0.16	.03	<.005	0.032	0.008	-
09/15/69	1255	-	-	-	-	05200	-	-	-	-	-	-
09/16/69	1005	-	-	-	-	06600	0.20	.02	<.005	0.030	<0.005	05
09/17/69	1015	-	-	05.1	-	07050	-	-	-	-	-	-

STATION NO. P07B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1010	07.0	-	03.9	-	04900	-	-	-	-	-	-
09/13/69	1645	-	-	10.0	-	04200	-	-	-	-	-	-
09/15/69	1255	-	-	-	-	07450	-	-	-	-	-	-
09/16/69	1005	-	-	-	-	08700	-	-	-	-	-	-
09/17/69	1015	-	-	03.2	-	09450	-	-	-	-	-	-

APPENDIX III
SUMMARY OF DATA
PERDIDO BAY - 9/9/69 TO 9/17/69

STATION NO. P08S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1140	01.0	24.0	07.8	094.1	03800	-	-	-	-	-	-
09/13/69	1319	-	25.0	-	-	03550	-	-	-	-	-	-
09/15/69	1000	-	-	-	-	03800	-	-	-	-	-	-
09/16/69	1050	-	-	-	-	05450	-	-	-	-	-	-
09/17/69	1038	-	26.5	06.5	085.4	06550	-	-	-	-	-	-

STATION NO. P08M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/09/69	1315	04.0	28.0	07.1	091.6	03500	-	-	-	-	-	-
09/10/69	0955	-	26.0	06.5	-	-	-	-	-	-	-	-
09/10/69	1445	-	27.0	04.3	062.9	07000	0.17	.01	<.005	0.018	<0.005	08
09/11/69	0915	-	24.0	07.7	092.6	03350	-	-	-	-	-	-
09/11/69	1455	-	25.0	-	-	03400	-	-	-	-	-	-
09/12/69	1140	04.0	-	07.7	-	03800	-	-	-	-	-	-
09/13/69	1319	-	-	-	-	03550	-	-	-	-	-	-
09/15/69	1000	-	-	-	-	03600	-	-	-	-	-	-
09/16/69	1050	-	-	-	-	05250	-	-	-	-	-	-
09/17/69	1038	-	-	06.9	-	06300	-	-	-	-	-	-

STATION NO. P08B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1140	08.0	-	08.0	-	03800	-	-	-	-	-	-
09/13/69	1319	-	-	-	-	11750	-	-	-	-	-	-
09/15/69	1000	-	-	06.9	-	09800	-	-	-	-	-	-
09/16/69	1050	-	-	-	-	10250	-	-	-	-	-	-
09/17/69	1038	-	-	01.8	-	10900	-	-	-	-	-	-

APPENDIX III
SUMMARY OF DATA
PERIOD BAY - 9/9/69 TO 9/17/69

STATION NO. P09S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1155	01.0	24.0	08.0	096.2	03450	-	-	-	-	-	-
09/13/69	1246	-	25.0	09.0	111.1	04300	-	-	-	-	-	-
09/15/69	1237	-	26.3	07.9	100.1	04700	-	-	-	-	-	-
09/16/69	1100	-	-	-	-	06050	-	-	-	-	-	-
09/17/69	1045	-	26.5	06.1	078.6	06150	-	-	-	-	-	-

STATION NO. P09M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/09/69	1450	03.5	29.0	07.5	098.0	03150	-	-	-	-	-	-
09/10/69	1130	-	26.0	07.1	088.3	03300	-	-	-	-	-	-
09/10/69	1620	-	26.0	08.0	100.1	03850	0.23	<.01	<.005	0.024	<0.005	12
09/11/69	1100	-	24.0	07.8	093.8	03350	-	-	-	-	-	-
09/11/69	1520	-	25.0	07.5	093.2	03650	-	-	-	-	-	-
09/12/69	1155	03.5	-	07.8	-	03500	0.17	.03	<.005	0.018	0.005	-
09/13/69	1246	-	-	08.9	-	04100	-	-	-	-	-	-
09/15/69	1237	-	-	08.0	-	04200	0.16	.02	<.005	0.026	0.020	-
09/16/69	1100	-	-	-	-	06100	-	-	-	-	-	-
09/17/69	1045	-	-	06.5	-	06600	0.19	.02	<.005	0.022	0.005	10

STATION NO. P09B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1155	07.0	-	07.5	-	03650	-	-	-	-	-	-
09/13/69	1246	-	-	06.9	-	05700	-	-	-	-	-	-
09/15/69	1237	-	-	04.5	-	07900	-	-	-	-	-	-
09/16/69	1100	-	-	-	-	07550	-	-	-	-	-	-

APPENDIX III
SUMMARY OF DATA
PERDIDO BAY - 9/9/69 TO 9/17/69

STATION NO. P10S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1025	01.0	24.0	07.2	086.6	03450	-	-	-	-	-	-
09/13/69	1550	-	26.0	09.7	130.5	11350	-	-	-	-	-	-
09/15/69	1318	-	25.8	08.4	106.0	05150	-	-	-	-	-	-
09/16/69	1105	-	-	-	-	06400	-	-	-	-	-	-
09/17/69	1050	-	25.5	06.8	088.2	06750	-	-	-	-	-	-

STATION NO. P10M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/09/69	1440	04.0	30.0	07.3	097.3	03500	0.10	.02	<.005	0.024	0.007	05
09/10/69	1135	-	26.0	07.3	091.0	03550	-	-	-	-	-	-
09/10/69	1615	-	26.0	08.4	105.0	03800	-	-	-	-	-	-
09/11/69	1055	-	24.0	09.1	109.9	03850	-	-	-	-	-	-
09/11/69	1630	01.0	26.0	10.0	124.7	03500	0.25	.03	<.005	0.024	0.015	-
09/12/69	1025	04.0	-	06.3	-	03850	-	-	-	-	-	-
09/13/69	1550	-	-	09.4	-	04250	0.14	.04	<.005	0.034	0.013	-
09/15/69	1318	-	-	08.2	-	05000	-	-	-	-	-	-
09/16/69	1105	-	-	-	-	06250	0.24	.03	<.005	0.035	0.005	05
09/17/69	1050	-	-	06.3	-	07350	-	-	-	-	-	-

STATION NO. P10B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1025	08.0	-	06.5	-	04050	-	-	-	-	-	-
09/13/69	1550	-	-	02.3	-	04200	-	-	-	-	-	-
09/15/69	1318	-	-	04.9	-	08000	-	-	-	-	-	-
09/16/69	1105	-	-	-	-	10750	-	-	-	-	-	-
09/17/69	1050	-	-	03.1	-	09850	-	-	-	-	-	-

APPENDIX III
SUMMARY OF DATA
PERDIDO BAY - 9/9/69 TO 9/17/69

STATION NO. P11S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1006	01.0	24.0	08.4	101.3	03750	-	-	-	-	-	-
09/13/69	1655	-	26.0	10.1	126.8	04250	-	-	-	-	-	-
09/15/69	1300	-	27.8	09.1	119.6	05850	-	-	-	-	-	-
09/16/69	1110	-	-	-	-	07250	-	-	-	-	-	-
09/17/69	1055	-	27.0	03.4	045.2	08450	-	-	-	-	-	-

STATION NO. P11M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/09/69	1425	03.5	29.0	07.4	096.7	03100	0.28	.07	<.005	0.024	0.011	05
09/10/69	1100	-	26.5	07.1	089.4	03650	-	-	-	-	-	-
09/10/69	1605	-	26.5	04.8	061.3	05250	-	-	-	-	-	-
09/11/69	1040	-	24.0	08.0	096.4	03650	-	-	-	-	-	-
09/11/69	1600	-	25.0	08.3	107.4	03700	0.19	.03	<.005	0.020	0.012	-
09/12/69	1006	03.5	-	08.5	-	03850	-	-	-	-	-	-
09/13/69	1655	-	-	07.7	-	04450	0.12	.05	<.005	0.028	0.005	-
09/15/69	1300	-	-	02.0	-	05550	-	-	-	-	-	-
09/16/69	1110	-	-	-	-	08950	0.19	.04	<.005	0.031	0.005	04
09/17/69	1055	-	-	02.8	-	08800	-	-	-	-	-	-

STATION NO. P11B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1006	07.0	-	04.3	-	06100	-	-	-	-	-	-
09/13/69	1655	-	-	02.1	-	09050	-	-	-	-	-	-
09/15/69	1300	-	-	01.4	-	09200	-	-	-	-	-	-
09/16/69	1110	-	-	-	-	10500	-	-	-	-	-	-
09/17/69	1055	-	-	04.2	-	08550	-	-	-	-	-	-

APPENDIX III
SUMMARY OF DATA
PERDIDO BAY - 7/9/69 TO 9/17/69

STATION NO. P12S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	0945	01.0	23.0	05.8	068.6	03600	-	-	-	-	-	-
09/13/69	1542	-	26.0	09.4	117.3	04150	-	-	-	-	-	-
09/15/69	1325	-	27.0	08.3	106.6	04850	-	-	-	-	-	-
09/16/69	1130	-	-	-	-	07400	-	-	-	-	-	-
09/17/69	1110	-	27.0	04.3	056.4	07050	-	-	-	-	-	-

STATION NO. P12M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/09/69	1437	04.0	29.0	07.3	102.0	03150	-	-	-	-	-	-
09/10/69	1115	-	26.0	06.6	082.2	03450	-	-	-	-	-	-
09/10/69	1630	-	26.0	07.2	089.9	03700	0.44	.03	<.005	0.036	<0.005	25
09/11/69	1030	-	24.0	07.2	086.4	03150	-	-	-	-	-	-
09/11/69	1620	-	25.0	07.4	096.8	03550	-	-	-	-	-	-
09/12/69	0945	04.0	-	06.5	-	03200	0.26	.03	<.005	0.025	0.013	-
09/13/69	1542	-	-	05.3	-	05350	-	-	-	-	-	-
09/15/69	1325	-	-	09.1	-	04600	0.32	.03	<.005	0.048	<0.005	-
09/16/69	1130	-	-	-	-	07950	-	-	-	-	-	-
09/17/69	1110	-	-	04.7	-	09450	0.22	.02	<.005	0.020	<0.005	08

STATION NO. P12B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	0945	08.0	-	04.6	-	04650	-	-	-	-	-	-
09/13/69	1542	-	-	02.4	-	10300	-	-	-	-	-	-
09/15/69	1325	-	-	03.4	-	09400	-	-	-	-	-	-
09/16/69	1130	-	-	-	-	10000	-	-	-	-	-	-
09/17/69	1110	-	-	02.4	-	10350	-	-	-	-	-	-

APPENDIX III
SUMMARY OF DATA
PERIOD DAY - 9/9/69 TO 9/17/69

STATION NO. P13S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1000	01.0	24.0	06.3	081.9	03550	-	-	-	-	-	-
09/13/69	1700	-	26.0	03.3	042.8	07700	-	-	-	-	-	-
09/15/69	1310	-	26.5	07.0	090.0	05850	-	-	-	-	-	-
09/16/69	1120	-	-	-	-	05400	-	-	-	-	-	-
09/17/69	1100	-	25.5	01.3	016.9	07400	-	-	-	-	-	-

STATION NO. P13M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/09/69	1550	02.0	29.0	06.5	084.7	01200	-	-	-	-	-	-
09/10/69	1105	-	26.0	05.8	071.5	02300	-	-	-	-	-	-
09/10/69	1640	-	27.0	05.8	072.9	02500	0.48	.09	.024	0.174	0.107	16
09/11/69	1045	-	25.0	06.7	081.7	03000	-	-	-	-	-	-
09/11/69	1605	-	25.0	06.7	081.6	02900	-	-	-	-	-	-
09/12/69	1000	02.0	-	06.8	-	02900	0.16	.03	.039	0.064	0.045	-
09/13/69	1700	-	-	02.9	-	08450	-	-	-	-	-	-
09/15/69	1310	-	-	06.8	-	05450	0.18	.03	.049	0.425	0.065	-

STATION NO. P13B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL #	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1000	04.0	-	07.1	-	03350	-	-	-	-	-	-
09/13/69	1700	-	-	03.2	-	07500	-	-	-	-	-	-
09/16/69	1120	-	-	-	-	09600	-	-	-	-	-	-
09/17/69	1100	-	-	00.8	-	09000	-	-	-	-	-	-

APPENDIX III
SUMMARY OF DATA
PERDIDO BAY - 9/9/69 TO 9/17/69

STATION NO. P14S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1545	01.0	26.0	09.0	113.1	04350	-	-	-	-	-	-
09/13/69	1155	-	25.0	07.5	092.4	04050	-	-	-	-	-	-
09/15/69	1017	-	25.0	06.5	079.9	03850	-	-	-	-	-	-
09/16/69	1205	-	-	-	-	05100	-	-	-	-	-	-
09/17/69	1140	-	26.5	05.5	071.5	05100	-	-	-	-	-	-

STATION NO. P14M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/09/69	1324	03.5	28.0	07.2	093.2	03900	0.21	.04	.009	0.020	0.014	05
09/10/69	1005	-	25.0	07.4	091.3	04300	-	-	-	-	-	-
09/10/69	1445	-	28.0	07.7	099.5	04600	-	-	-	-	-	-
09/11/69	0915	-	-	07.5	-	04200	-	-	-	-	-	-
09/11/69	1455	-	26.0	08.2	102.4	03650	0.13	.04	<.005	0.013	0.012	-
09/12/69	1545	03.5	-	07.7	-	05050	-	-	-	-	-	-
09/13/69	1155	-	-	08.4	-	04100	0.17	.04	<.005	0.029	<0.005	-
09/15/69	1017	-	-	08.1	-	04200	-	-	-	-	-	-
09/16/69	1205	-	-	-	-	04900	0.30	.03	.008	0.020	<0.005	05
09/17/69	1140	-	-	05.5	-	05500	-	-	-	-	-	-

STATION NO. P14B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1545	07.0	-	04.2	-	10400	-	-	-	-	-	-
09/13/69	1155	-	-	06.2	-	05300	-	-	-	-	-	-
09/15/69	1017	-	-	08.1	-	09750	-	-	-	-	-	-
09/16/69	1205	-	-	-	-	10900	-	-	-	-	-	-
09/17/69	1140	-	-	05.0	-	06350	-	-	-	-	-	-

APPENDIX III
SUMMARY OF DATA
PERDIDO BAY - 9/9/69 TO 9/17/69

STATION NO. P15S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1525	01.0	25.0	07.5	092.0	03600	-	-	-	-	-	-
09/13/69	1227	-	25.0	08.4	105.4	03500	-	-	-	-	-	-
09/15/69	0955	-	24.4	08.2	101.3	04800	-	-	-	-	-	-
09/16/69	1140	-	-	-	-	06500	-	-	-	-	-	-
09/17/69	1125	-	25.5	05.7	073.0	06450	-	-	-	-	-	-

STATION NO. P15M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/09/69	1317	03.0	27.0	06.2	078.4	03200	-	-	-	-	-	-
09/10/69	0955	-	25.0	06.6	080.6	03100	-	-	-	-	-	-
09/10/69	1440	-	24.0	07.8	093.4	02950	-	-	-	-	-	-
09/11/69	0906	-	-	07.2	-	03300	-	-	-	-	-	-
09/11/69	1445	-	25.0	06.7	083.0	04650	-	-	-	-	-	-
09/12/69	1525	03.0	-	03.1	-	03450	-	-	-	-	-	-
09/13/69	1227	-	-	08.3	-	03900	0.22	.04	.008	0.037	0.011	-
09/15/69	0955	-	-	07.4	-	04450	-	-	-	-	-	-
09/16/69	1140	-	-	-	-	06550	-	-	-	-	-	-
09/17/69	1125	-	-	05.7	-	06500	-	-	-	-	-	-

STATION NO. P15B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1525	06.0	-	03.0	-	10600	-	-	-	-	-	-
09/13/69	1227	-	-	03.1	-	09950	-	-	-	-	-	-
09/15/69	0955	-	-	03.2	-	09150	-	-	-	-	-	-
09/16/69	1140	-	-	-	-	08000	-	-	-	-	-	-

APPENDIX III
SUMMARY OF DATA
PERDIDO BAY - 9/9/69 TO 9/17/69

STATION NO. P15S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1155	01.0	24.0	07.6	091.5	03500	-	-	-	-	-	-
09/13/69	1237	-	25.0	08.1	099.4	03700	-	-	-	-	-	-
09/15/69	0950	-	24.9	07.9	096.6	04800	-	-	-	-	-	-
09/16/69	1135	-	-	-	-	07050	-	-	-	-	-	-
09/17/69	1115	-	26.5	05.4	069.8	06450	-	-	-	-	-	-

STATION NO. P16M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/09/69	1310	03.5	28.0	07.5	096.3	03000	0.25	.09	<.005	0.026	0.006	05
09/10/69	0945	-	25.0	07.1	087.1	03650	-	-	-	-	-	-
09/10/69	1435	-	24.0	07.7	092.6	03450	-	-	-	-	-	-
09/11/69	0905	-	-	07.9	-	03350	-	-	-	-	-	-
09/11/69	1440	-	25.0	07.6	094.0	04500	0.13	.04	<.005	0.019	0.012	-
09/12/69	1155	03.0	-	07.3	-	03550	-	-	-	-	-	-
09/13/69	1237	-	-	08.0	-	03650	-	-	-	-	-	-
09/15/69	0950	-	-	07.6	-	04650	-	-	-	-	-	-
09/16/69	1135	-	-	-	-	07000	0.25	.13	<.005	0.150	0.016	08
09/17/69	1115	-	-	05.9	-	06500	-	-	-	-	-	-

STATION NO. P16B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1155	06.0	-	05.4	-	06650	-	-	-	-	-	-
09/13/69	1237	-	-	02.0	-	10300	-	-	-	-	-	-
09/15/69	0950	-	-	02.3	-	09150	-	-	-	-	-	-
09/16/69	1135	-	-	-	-	10400	-	-	-	-	-	-
09/17/69	1115	-	-	03.5	-	08700	-	-	-	-	-	-

APPENDIX III
SUMMARY OF DATA
PERDIDO BAY - 9/9/69 TO 9/17/69

STATION NO. P17S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1600	31.0	26.0	09.0	113.3	04550	-	-	-	-	-	-
09/13/69	1148	-	25.0	08.6	106.0	04100	-	-	-	-	-	-
09/15/69	1023	-	25.1	08.2	101.9	04650	-	-	-	-	-	-
09/16/69	1220	-	-	-	-	04700	-	-	-	-	-	-
09/17/69	1145	-	25.5	05.2	066.7	05600	-	-	-	-	-	-

STATION NO. P17M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/09/69	1335	25.0	28.2	06.2	091.5	04700	-	-	-	-	-	-
09/10/69	1013	-	26.0	06.3	079.7	05050	-	-	-	-	-	-
09/10/69	1507	-	26.0	02.6	033.1	09800	0.24	.10	<.005	0.025	0.010	04
09/11/69	0924	-	-	01.7	-	11400	-	-	-	-	-	-
09/11/69	1535	-	25.1	03.3	044.5	11650	-	-	-	-	-	-
09/12/69	1600	05.0	-	06.3	-	06500	0.16	.04	<.005	0.014	0.005	-
09/13/69	1148	-	-	07.2	-	05100	-	-	-	-	-	-
09/15/69	1023	-	-	08.0	-	04550	0.16	.02	<.005	0.023	<0.005	-
09/16/69	1220	-	-	-	-	05000	-	-	-	-	-	-
09/17/69	1145	-	-	05.2	-	05650	-	-	-	-	-	-

STATION NO. P17B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1600	10.0	-	07.5	-	12600	-	-	-	-	-	-
09/13/69	1148	-	-	-	-	11000	-	-	-	-	-	-
09/15/69	1023	-	-	07.5	-	05900	-	-	-	-	-	-
09/16/69	1220	-	-	-	-	07400	-	-	-	-	-	-
09/17/69	1145	-	-	05.3	-	05650	-	-	-	-	-	-

APPENDIX III
SUMMARY OF DATA
PERDIDO BAY - 9/9/69 TO 9/17/69

STATION NO. P18S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1535	01.0	26.0	08.5	106.4	03900	-	-	-	-	-	-
09/13/69	0945	-	-	-	-	03700	-	-	-	-	-	-
09/15/69	1005	-	25.1	06.8	084.3	04350	-	-	-	-	-	-
09/17/69	1120	-	25.5	06.1	078.7	06300	-	-	-	-	-	-

STATION NO. P18M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/09/69	1322	03.0	28.0	07.0	090.3	03550	-	-	-	-	-	-
09/10/69	1000	-	25.2	07.4	092.9	03750	-	-	-	-	-	-
09/10/69	1450	-	25.0	07.7	094.4	03600	-	-	-	-	-	-
09/11/69	0911	-	-	07.4	-	03500	-	-	-	-	-	-
09/11/69	1450	-	25.0	06.1	076.6	06200	-	-	-	-	-	-
09/12/69	1535	03.0	-	06.4	-	07950	-	-	-	-	-	-
09/13/69	1216	-	-	03.4	-	03650	-	-	-	-	-	-
09/15/69	1005	-	-	07.5	-	04350	-	-	-	-	-	-
09/16/69	1200	-	-	-	-	05650	-	-	-	-	-	-
09/17/69	1120	-	-	05.5	-	06550	-	-	-	-	-	-

STATION NO. P18B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1535	06.0	-	05.7	-	08500	-	-	-	-	-	-
09/13/69	1216	-	-	04.6	-	03800	-	-	-	-	-	-
09/15/69	1055	-	-	06.3	-	07550	-	-	-	-	-	-
09/16/69	1200	-	-	-	-	08900	-	-	-	-	-	-
09/17/69	1120	-	-	03.5	-	09600	-	-	-	-	-	-

APPENDIX III
SUMMARY OF DATA
PERDIDO BAY - 9/9/69 TO 9/17/69

STATION NO. P19S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1605	01.0	26.0	08.8	110.9	04600	-	-	-	-	-	-
09/13/69	1140	-	24.5	08.9	108.8	04200	-	-	-	-	-	-
09/15/69	1010	-	24.8	08.7	107.2	04500	-	-	-	-	-	-
09/16/69	1230	-	-	-	-	05450	-	-	-	-	-	-
09/17/69	1150	-	25.5	06.4	082.0	05500	-	-	-	-	-	-

STATION NO. P19M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/09/69	1341	03.5	27.0	07.1	090.9	04500	-	-	-	-	-	-
09/10/69	1016	-	25.0	07.5	092.2	03850	-	-	-	-	-	-
09/10/69	1511	-	26.0	06.9	087.1	04850	-	-	-	-	-	-
09/11/69	0929	-	23.0	07.4	088.2	04400	-	-	-	-	-	-
09/11/69	1510	-	25.0	07.1	089.1	05000	-	-	-	-	-	-
09/12/69	1605	03.5	-	09.0	-	04300	-	-	-	-	-	-
09/13/69	1140	-	-	08.0	-	04350	-	-	-	-	-	-
09/15/69	1010	-	-	08.2	-	04650	-	-	-	-	-	-
09/16/69	1230	-	-	-	-	05200	-	-	-	-	-	-
09/17/69	1150	-	-	06.3	-	05800	-	-	-	-	-	-

STATION NO. P19B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1605	07.0	-	07.0	-	06850	-	-	-	-	-	-
09/13/69	1140	-	-	03.3	-	08800	-	-	-	-	-	-
09/15/69	1010	-	-	07.4	-	06300	-	-	-	-	-	-
09/16/69	1230	-	-	-	-	05600	-	-	-	-	-	-
09/17/69	1150	-	-	05.8	-	05650	-	-	-	-	-	-

09

APPENDIX III
SUMMARY OF DATA
PERDIDO BAY - 9/9/69 TO 9/17/69

STATION NO. P20S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1550	01.0	26.0	09.1	113.9	03950	-	-	-	-	-	-
09/13/69	1206	-	25.0	08.0	098.5	04000	-	-	-	-	-	-
09/15/69	1030	-	25.0	08.2	101.9	05000	-	-	-	-	-	-
09/16/69	1245	-	-	-	-	05850	-	-	-	-	-	-
09/17/69	1135	-	26.5	06.4	082.5	06150	-	-	-	-	-	-

STATION NO. P20M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/09/69	1340	03.5	29.0	06.4	084.9	04750	0.19	.06	<.005	0.016	<0.005	05
09/10/69	1010	-	25.0	07.1	087.6	03550	-	-	-	-	-	-
09/10/69	1500	-	25.0	07.9	096.9	03600	-	-	-	-	-	-
09/11/69	0919	-	-	08.0	-	04200	-	-	-	-	-	-
09/11/69	1500	-	25.0	07.4	091.6	04650	0.14	.03	<.005	0.014	0.009	-
09/12/69	1550	03.5	-	03.4	-	09700	-	-	-	-	-	-
09/13/69	1206	-	-	06.8	-	06800	0.19	.04	<.005	0.056	0.005	-
09/15/69	1030	-	-	08.1	-	04900	-	-	-	-	-	-
09/16/69	1245	-	-	-	-	06100	0.17	.04	<.005	0.016	<0.005	05
09/17/69	1135	-	-	04.2	-	06150	-	-	-	-	-	-

STATION NO. P20B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1550	07.0	-	03.0	-	09700	-	-	-	-	-	-
09/13/69	1206	-	-	04.2	-	09400	-	-	-	-	-	-
09/15/69	1030	-	-	06.7	-	07300	-	-	-	-	-	-
09/16/69	1245	-	-	-	-	09800	-	-	-	-	-	-
09/17/69	1135	-	-	03.8	-	C8650	-	-	-	-	-	-

APPENDIX III
SUMMARY OF DATA
PERDIDO BAY - 9/9/69 TO 9/17/69

STATION NO. P21S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1615	01.0	25.0	08.5	109.0	05400	-	-	-	-	-	-
09/13/69	1045	-	24.0	08.3	101.6	05250	-	-	-	-	-	-
09/15/69	1035	-	25.5	07.7	097.0	05550	-	-	-	-	-	-
09/16/69	1325	-	-	-	-	06400	-	-	-	-	-	-
09/17/69	1155	-	26.3	06.7	086.0	06100	-	-	-	-	-	-

STATION NO. P21M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/09/69	1352	04.5	29.0	07.2	094.8	05650	-	-	-	-	-	-
09/10/69	1023	-	25.0	06.1	076.3	05700	-	-	-	-	-	-
09/10/69	1517	-	26.0	07.1	090.4	05800	0.13	.04	<.005	0.016	0.005	05
09/11/69	0934	-	24.5	06.7	085.2	08300	-	-	-	-	-	-
09/11/69	1515	-	26.0	05.6	074.7	10500	-	-	-	-	-	-
09/12/69	1615	04.5	-	07.8	-	05600	0.16	.04	<.005	0.010	0.005	-
09/13/69	1045	-	-	08.4	-	04750	-	-	-	-	-	-
09/15/69	1035	-	-	08.3	-	05550	0.12	<.01	<.005	0.021	<0.005	-
09/16/69	1325	-	-	-	-	06800	-	-	-	-	-	-
09/17/69	1155	-	-	05.7	-	07300	0.16	.01	<.005	0.018	<0.005	06

STATION NO. P21B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1515	09.0	-	04.3	-	10750	-	-	-	-	-	-
09/13/69	1045	-	-	04.6	-	10650	-	-	-	-	-	-
09/15/69	1035	-	-	07.3	-	10250	-	-	-	-	-	-
09/16/69	1325	-	-	-	-	11200	-	-	-	-	-	-
09/17/69	1155	-	-	04.3	-	10250	-	-	-	-	-	-

APPENDIX III
SUMMARY OF DATA
PERDIDO BAY - 9/9/69 TO 9/17/69

STATION NO. P22S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1625	01.0	26.0	08.1	103.7	06300	-	-	-	-	-	-
09/13/69	1056	-	24.5	07.9	098.4	06200	-	-	-	-	-	-
09/15/69	1043	-	25.5	07.6	097.4	07350	-	-	-	-	-	-
09/16/69	1405	-	-	-	-	07100	-	-	-	-	-	-
09/17/69	1203	-	25.5	06.1	079.2	06900	-	-	-	-	-	-

STATION NO. P22M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/09/69	1357	04.0	28.0	04.1	055.3	03250	-	-	-	-	-	-
09/10/69	1100	-	25.0	06.7	084.3	06350	-	-	-	-	-	-
09/10/69	1525	-	26.0	07.5	097.6	06600	-	-	-	-	-	-
09/11/69	0938	-	25.0	05.5	071.2	09250	-	-	-	-	-	-
09/11/69	1520	-	26.0	06.1	080.4	09300	-	-	-	-	-	-
09/12/69	1625	04.0	-	08.1	-	06200	-	-	-	-	-	-
09/13/69	1056	-	-	08.4	-	06500	-	-	-	-	-	-
09/15/69	1043	-	-	07.3	-	07350	-	-	-	-	-	-
09/16/69	1405	-	-	-	-	07650	-	-	-	-	-	-
09/17/69	1203	-	-	-	-	08600	-	-	-	-	-	-

STATION NO. P22B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1625	08.0	-	04.6	-	11300	-	-	-	-	-	-
09/13/69	1056	-	-	05.5	-	09400	-	-	-	-	-	-
09/15/69	1043	-	-	04.0	-	11050	-	-	-	-	-	-
09/16/69	1405	-	-	-	-	12450	-	-	-	-	-	-
09/17/69	1203	-	-	03.3	-	12250	-	-	-	-	-	-

APPENDIX III
SUMMARY OF DATA
PERDIDO BAY - 9/9/69 TO 9/17/69

STATION NO. P23S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1630	01.0	26.0	08.5	108.6	06100	-	-	-	-	-	-
09/13/69	1106	-	24.5	08.3	103.5	06350	-	-	-	-	-	-
09/15/69	1048	-	25.5	07.6	096.6	06450	-	-	-	-	-	-
09/16/69	1335	-	-	-	-	06950	-	-	-	-	-	-
09/17/69	1215	-	26.5	05.7	073.8	06600	-	-	-	-	-	-

STATION NO. P23M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/09/69	1401	04.0	28.0	06.3	083.1	05900	-	-	-	-	-	-
09/10/69	1030	-	26.0	05.5	071.1	07350	-	-	-	-	-	-
09/10/69	1532	-	25.0	07.6	096.0	06700	-	-	-	-	-	-
09/11/69	0942	-	23.5	07.5	091.9	06350	-	-	-	-	-	-
09/11/69	1525	-	25.0	07.3	098.2	06350	-	-	-	-	-	-
09/12/69	1630	04.0	-	08.3	-	06100	-	-	-	-	-	-
09/13/69	1106	-	-	08.3	-	06150	-	-	-	-	-	-
09/15/69	1048	-	-	08.0	-	06600	-	-	-	-	-	-
09/16/69	1335	-	-	-	-	06700	-	-	-	-	-	-
09/17/69	1215	-	-	05.5	-	06550	-	-	-	-	-	-

STATION NO. P23B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1630	08.0	-	03.3	-	11850	-	-	-	-	-	-
09/13/69	1106	-	-	03.4	-	11000	-	-	-	-	-	-
09/15/69	1048	-	-	03.1	-	10800	-	-	-	-	-	-
09/16/69	1335	-	-	-	-	07000	-	-	-	-	-	-
09/17/69	1215	-	-	04.5	-	10900	-	-	-	-	-	-

APPENDIX III
SUMMARY OF DATA
PERDIDO BAY - 9/9/69 TO 9/17/69

STATION NO. P24S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1640	01.0	26.0	08.2	106.1	07450	-	-	-	-	-	-
09/13/69	1114	-	24.0	08.1	100.5	06700	-	-	-	-	-	-
09/16/69	1350	-	-	-	-	07600	-	-	-	-	-	-
09/17/69	1225	-	26.9	06.7	088.1	07700	-	-	-	-	-	-

STATION NO. P24M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/09/69	1406	06.0	29.0	05.5	075.5	08350	-	-	-	-	-	-
09/10/69	1055	-	25.0	05.8	073.9	07650	-	-	-	-	-	-
09/10/69	1540	-	25.0	07.5	095.2	07250	-	-	-	-	-	-
09/11/69	0948	-	25.0	04.1	054.7	12300	-	-	-	-	-	-
09/11/69	1530	-	25.0	08.1	102.7	07150	-	-	-	-	-	-
09/12/69	1640	06.0	-	08.3	-	07300	-	-	-	-	-	-
09/13/69	1114	-	-	07.7	-	06800	-	-	-	-	-	-
09/16/69	1350	-	-	-	-	09000	-	-	-	-	-	-
09/17/69	1225	-	-	04.9	-	10450	-	-	-	-	-	-

STATION NO. P24B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/12/69	1640	12.0	-	05.6	-	10650	-	-	-	-	-	-
09/13/69	1114	-	-	06.2	-	10400	-	-	-	-	-	-
09/16/69	1350	-	-	-	-	10950	-	-	-	-	-	-
09/17/69	1225	-	-	05.1	-	10750	-	-	-	-	-	-

APPENDIX III
SUMMARY OF DATA
PERDIDO BAY - 9/9/69 TO 9/17/69

STATION NO. P25S

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/13/69	1122	-	24.0	08.3	103.0	06750	-	-	-	-	-	-
09/15/69	1055	-	25.0	07.4	093.8	07100	-	-	-	-	-	-
09/16/69	1355	-	-	-	-	07050	-	-	-	-	-	-
09/17/69	1230	-	25.8	06.6	086.7	07550	-	-	-	-	-	-

STATION NO. P25M

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/09/69	1410	05.0	25.0	06.8	086.1	07050	-	-	-	-	-	-
09/10/69	1045	-	25.0	07.2	092.7	06950	-	-	-	-	-	-
09/10/69	1550	-	25.0	07.9	101.7	06850	-	-	-	-	-	-
09/11/69	0954	-	25.0	06.3	082.3	10150	-	-	-	-	-	-
09/11/69	1535	-	25.0	07.9	100.5	07500	-	-	-	-	-	-
09/13/69	1122	-	-	08.4	-	06450	-	-	-	-	-	-
09/15/69	1055	-	-	07.6	-	07200	-	-	-	-	-	-
09/16/69	1355	-	-	-	-	07150	-	-	-	-	-	-
09/17/69	1230	-	-	06.3	-	07550	-	-	-	-	-	-

STATION NO. P25B

DATE	TIME HRS	DEPTH FT	TEMP C	D.O. MG/L	D.O. %SAT	CL	TKN-N MG/L	NH3-N MG/L	NO2-NO3 MG/L	T-PHOS MG/L	O-PHOS MG/L	TOC MG/L
09/13/69	1122	-	-	07.3	-	08400	-	-	-	-	-	-
09/15/69	1055	-	-	04.6	-	11250	-	-	-	-	-	-
09/16/69	1355	-	-	-	-	13550	-	-	-	-	-	-
09/17/69	1230	-	-	04.2	-	12600	-	-	-	-	-	-